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See Page 61

NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS  
HOME WORKSHOP PLANS AND HINTS • 450 PICTURES



# NEW KIND OF TIRE

GIVES THE *QUICKEST* NON-SKID  
STOPS YOU'VE EVER SEEN!



## HERE'S THE EVIDENCE

from America's Largest  
Independent Testing Laboratory

**BOTH** regular, and also the premium-priced tires of America's six largest tire manufacturers were submitted to a series of exhaustive road tests made over a three months' period by us, to determine their resistance to skidding and wear, with the following results:

**"NON-SKID"**—The new Goodrich Silvertown with the Life-Saver Tread gave greater skid resistance than any other tire tested, including those tires listed at from 40% to 70% higher in price.

**"MILEAGE"**—The Goodrich Silvertown gave more non-skid mileage than any of the other tires tested in its own price range—averaged 19.1% more miles before the tires wore smooth.

**"BLOW-OUT PROTECTION"**—Despite the severe nature of these tests, no Silvertown blew out, or failed from any cause, while two tires of other makes failed.

A. R. Ellis, Pres.  
PITTSBURGH TESTING LABORATORY



## LIFE-SAVER TREAD WORKS LIKE A BATTERY OF WINDSHIELD WIPERS

Sweeps the water right and left—forces it out through the deep drainage grooves. Thus, with Goodrich Safety Silvertowns on your car, you constantly have a dryer, safer road surface for the rubber to grip—in all directions.



## Wins Hands Down in Thrilling Competitive Road Tests Conducted by Famous Testing Laboratory!

**AGAIN** Goodrich makes tire history! Meeting the demands of millions of motorists for greater protection against skidding, Goodrich engineers have perfected a remarkable new kind of tire that conquers wet road skid dangers in a sensational way.

In exhaustive road tests made by the Pittsburgh Testing Laboratory, largest independent testing laboratory in the country, against regular and premium-priced tires of America's six largest tire manufacturers, *no tire tested*—even those costing 40% to 70% more—matched this tire in non-skid action.

### Golden Ply Blow-out Protection

The new Goodrich Silvertown is really *two* great tires combined in one! For *inside* the carcass is the famous Goodrich Golden Ply protection against high-speed blow-outs. And *outside* is the new Life-Saver Tread which stops you quicker, safer than you've ever stopped before. That's because

this amazing tread is actually a *road dryer*! Its never-ending spiral bars, acting like a battery of windshield wipers, sweep water from under the tire, force it out through the deep drainage grooves—make a *dry track* for the rubber to grip.

### No Extra Cost!

Go to your Goodrich dealer or Goodrich Silvertown Store for a *free* demonstration that will give you one of the greatest motoring thrills you ever had. Don't miss it, because you'll never know what the word STOP really means until you've felt the grip of this Silvertown on a wet, slippery road.

Remember, this new skid-protected Goodrich Silvertown also has the famous Golden Ply protection against blow-outs. So you get *two* great life-saving features—AT NO EXTRA COST!—to say nothing of 19.1% greater non-skid tire mileage—which means you get EVERY 6TH MILE FREE!

*The new* Goodrich **SAFETY** Silvertown

SKID PROTECTION OF LIFE-SAVER TREAD ◆ ◆ ◆ GOLDEN PLY BLOW-OUT PROTECTION



# FIRST CHOICE OF MILLIONS

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## **Get a Genuine General Electric and Save the Difference!**

General Electric originated the hermetically sealed Thrift Unit and the 5-Year Performance Protection Plan. No other refrigerator has a sealed cold-making mechanism with a record equal to that of G-E. No other refrigerator, under actual home conditions, can freeze more ice, preserve more food, give more convenience and produce more cold for the little current cost of a General Electric! Its record of low upkeep speaks for itself. *Get the genuine General Electric—not an imitation!*



**TAILOR-MADE INTERIORS!** The new de luxe General Electric cabinets have more flexible and usable storage space, more convenience features. Adjustable sliding shelves, split shelf, tilt-shelf and food containers provide accommodation for practically any food-storage need.

GENERAL ELECTRIC CO., SPECIALTY APPLIANCE DIVISION, NELA PARK, CLEVELAND, O.

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ALDEN P. ARMAGNAC, Associate Editor

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COVER DESIGN BY EDGAR F. WITTMACK



Balloon-bursting, one of the events in a track meet of the air. Read the article on page 33 describing this new college sport

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# Electroplating

FOR HOBBY OR PROFIT

## ALL YOU NEED TO KNOW IN ONE PRACTICAL HANDBOOK

Written especially for the amateur, this book tells you how to utilize many odds and ends to build a complete home electroplating workshop. Instructions, pictures, and diagrams show how easy you can do copper, nickel, chromium, silver and gold plating. How you can plate household or automobile fixtures, hardware, tools, silverware, ornaments, clocks, watches, bracelets, rings, metal parts of all kinds.

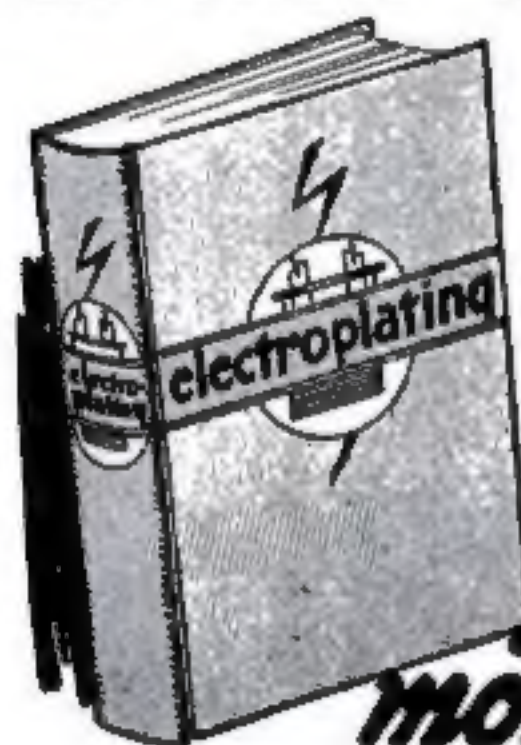
## FOR THE BEGINNER OR THE EXPERT

Takes you in easy-to-grasp stages right from the simple first principles of electroplating to expert professional type work. It's interesting and profitable also to plate non-metallic articles made from wood—fabric—leather—plastics—glass or porcelain. You can get results plating less commonly used metals such as zinc, cadmium, cobalt, antimony, lead, rhodium, and alloys. How to do lacquering, inlaying, overlaying, etching. How to plate unusual designs with contrasting metals for striking effects,—obtain unusual finishes with chemical coloring. Scores of illustrations, diagrams, and pictures make it easy to do electroplating in all its branches.

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DE SOTO



CHRYSLER



A.M. SANTAM

## AUTO-LITE ENGINEERS SAW NEED FOR NEW KIND OF SPARK PLUG

FOR 26 years the engineers of Electric Auto-Lite have specialized in starting, lighting and ignition equipment for motor cars.

To improve the present-day ignition system was one of their pet aims. To do it, they found they needed a better spark plug than any they could buy. So they perfected a new kind of spark plug—one engineered as an integral, balanced unit of the ignition system *instead of as an accessory.*

They developed an entirely new electrode which, under identical conditions, requires a much lower voltage to produce a spark. *Faster action!* Cold motors start easier! Gasoline waste is eliminated! Top speed is increased!

Get a set of Auto-Lites today. They put new life in your motor—pay for themselves over and over, and over again, in gasoline savings!

# AUTO-LITE

SPARK PLUGS



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# Our Readers Say



## When Is a Straight Line Not a Straight Line?

ANYONE interested in optical illusions can find an inadvertent but particularly striking one in an illustration that appeared in your April issue, on page 73 of the Home-Workshop Department, under the title, "Cutting Wooden Arcs with Little Waste." Look at the solid line, in the lower view, that separates sections A and B. It is a straight line, but you simply won't believe it until you place a ruler alongside of it! The three curved, dotted lines near-by make the straight one appear to be bowed the other way. What's more, the whole wooden piece shown in the lower view seems warped like part of a hoop, whereas the curvature actually lies all in one plane.—R. G., Rutherford, N. J.

COCKEYED? HAW,  
JUST AN OPTICAL  
ILLUSION!



## Perhaps It Proves That You Shouldn't Play Poker

FEELING that extrasensory perception (telepathy to you) would come in handy if you could use it to read somebody else's poker hand, I've been trying out some of Dr. Rhine's experiments with his fancy pack of twenty-five cards marked with circles, wavy lines, and so on. To my dismay, I find that my scores at "calling" the cards while some one else looks at them are not only no better than might be expected by pure chance, but actually, after repeated trials, are subnormal! Now, what does that prove?—P.H., Atlanta, Ga.

## Reader Wonders How Spent a Spent Bullet Really Is

HAVING a practical problem which has puzzled me for a long time, I finally decided that writing to you would be the best way of solving it. Here it is. I do a good deal of target practice in the country. It consists largely of throwing tin cans into the air and trying to hit them. What I want to know is this: At what angle from the horizontal is it safe to shoot upwards so that the bullet will fall dead and not do any harm if it lands on some one. Theoretically, the bullet would have the same power as when it left the gun, if it were not for air resistance. Would this cut down the power enough to make the bullet land harmlessly, provided it is fired at or above a given angle, and, I repeat, what is this angle? I use a .22 caliber short, which the advertisements tell me has a muzzle velocity of 1,142 feet a second, dropping to 904 feet a second at 100 yards. I'm sure some one can answer this.—L. W. D., Elmhurst, Ill.

THIS BELONGS TO  
THE GUN BUGS  
IN OUTDOOR LIFE!



## It's Just a Matter of Dollars and Sense

YOU MAY claim that this problem has more than one solution. If you think so, then try to find one, which I assure you exists. A man had three married daughters, Mrs. Jones, Mrs. Smith, and Mrs. White. Each had one child. When the old man died, his fortune was distributed according to his will among his daughters, sons-in-law, and grandchildren as follows: Each of the nine persons received a number of envelopes (a different number for each), each envelope containing a number of dollars equal to the number of envelopes which that person received. The share of money for each woman exceeded her husband's share by the same amount as her husband's exceeded her child's. No two families received the same amount of money, but all three families received the same number of envelopes. The number of envelopes received by Mrs. Jones and Mrs. Smith together equaled the number received by Mrs. White and Mr. Jones. All nine persons were penniless before the bequests. Afterward, all were wealthy, but none was a millionaire. What were the nine sums of money distributed by the will?—C.T., Antigonish, Canada.

## Wants Range-Finder Plans for Small Boats

BEING a boat owner as well as a radio fan, I'd like to make a suggestion for an article. How about giving us simplified plans for a portable, self-contained radio direction finder that can be used on a small boat? Boat owners all over the world have need for such a circuit. The practical advantages of a water-tight cabinet for the set are quite obvious, so will you include specifications for this, too?—W.I.N., Saugus, Mass.

I'D RATHER LISTEN TO  
JACK BENNY!



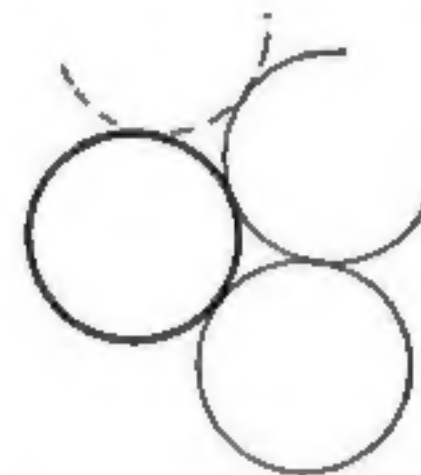
## Inventor of Automatic 'Chute Jumps onto a Critic

LIKE R.A.D., Omaha, Nebr., I am fond of gadgets and for that reason am an old subscriber to your interesting and instructive magazine. Also, I happen to be the inventor of the automatic parachute described in your February issue and commented on by R.A.D. in "Our Readers Say" for March. So he would be afraid to use my automatic 'chute for fear a mechanic might have left out a gear? Well, our timid friend has the wrong conception of the way my 'chute works. He would not be called upon to hold the "little wind vane." That takes care of itself. All he would have to do is to jump and forget all about the little wind vane. His speed through the air would do the rest. In fact, if he should happen to swoon before jumping time and some

one thoughtfully tossed him out of the ship, the automatic 'chute would function and let him down, gently but firmly.—H. A. Burgess, Los Angeles, Calif.

## This Will Set Your Head Spinning in Circles

THAT problem about the compressed spheres furnishes a lot of food for thought for the delvers into the abstract. It reminded me of one of my own inventions, which I hereby pass along for the mathematically minded. Given a number of pennies or other circles of equal size, what is the greatest number of them that can be laid around a single one, so all the outer circles touch the central one? Can you prove it?—A.H.S., Allentown, Pa.



## He Just Rivets His Attention on Photography Hints

How anyone with the intelligence to read and appreciate P.S.M. can waste valuable hours turning old film spools into washers and rivets, as does H.S.M., according to his letter in "Readers Say," is more than I can fathom! Time down in Maine must be worth all of six thousandths of a cent an hour at that rate, because you can buy a whole bag of assorted rivets and washers from any mail-order house for about twenty cents. Well, every man to his tastes, and my taste is to keep up with photography hints and methods.—C.W.C., Rochester, N.Y.

## That's a Fancy Name for a Compressed Soap Bubble

W.E.M. ASKED what shape soap bubbles—which may be considered as perfect spheres—would take if crowded together in a small space in such a way that all the spaces between them would be taken up. This has been calculated mathematically, though I do not know the method used. But I have studied this shape in connection with histology, the science of the structure of minute organic tissues. Since living cells may be considered as essentially spherical in shape, they would react the same as soap bubbles under the conditions being considered. It has been found that cells packed in layers without greatly unequal pressures assume an orthic-tetrahedraicahedronal shape, which has fourteen sides, or facets. Eight of these facets have four edges, the rest six edges. It is interesting to note that this shape gives the cells the max- (Continued on page 7)

S'MORE FUN LOOKING  
AT BUBBLES IN A BEER  
BOTTLE!





(Continued from page 6)

imum of traction with each other and, at the same time, the minimum number of angles and sides. If they were cubic, they would tend to slide over one another. W.E.M. may be able to demonstrate this effect by shaking some soapy water in a bottle and observing the bubbles of the lather.—R.L.M., Palo Alto, Calif.

### Imagine Ordering Dinner from Your Coal Dealer!

Don't the people of Germany process coal into an edible food? If so, why don't the people of the United States do likewise? Coal is composed of decayed vegetable matter; in other words, condensed vegetable matter or condensed carbon. Coal is carbon, and carbon contains heat. Couldn't the scientists of America figure out some way to put this coal into capsules for an edible food?

SAY, COAL COSTS ENOUGH NOW!



Or, maybe the coal, if eaten moderately, is all right without being processed. My theory is based on the proposition that the essential value of food is heat—to heat the human body. If my theory is correct, Americans are wasting a lot of coal food by burning it up in stoves and furnaces instead of in their own bodies. Coal may taste a little bitter, but most all bitter foods are good for the human body. I believe that the human body could adapt itself in a short time to the chemical process of converting coal into heat energy in a way similar to the heat-converting process of coal by oxidation or combustion. Some people have used coal, in small quantities, as a stomach medicine. Pigs can eat coal without any apparent harm, unless allowed to eat too much of it. If man could solve the food problem, think how far science could advance when man could apply his intelligence without worrying about food.—A.F.S., Princeton, Ind.

### You Can't Build a Subigible or a Dirmarine

Your timely articles on the submarine and the dirigible in the April issue made me wonder if it was accident or design that made you run them together. I had never realized until I read them how similar the two types of craft are. Their similarity of lines is obvious. Less obvious, however, are the following facts: Both weigh approximately the same as the operating mediums they displace. Both are driven by screw propellers revolving in those mediums, and are maneuvered by variation of their weight and by movement of their exterior controlling planes or surfaces. Both are affected by temperature changes of the mediums in which they operate, and both depend almost entirely on some kind of special supply base. Both were invented for purposes of war, and both have been converted to peacetime use. Both are

KIPLING SAID IT, A SUB'S A SUB AND A DIRIGIBLE IS A D'RIGIBLE AND AINT NEVER GONNA MEET!



(Continued on page 8)

## The Case of a DELCO BATTERY



DIELECTRIC TEST

All Delco battery cases are made of genuine hard rubber in Delco-Remy's battery

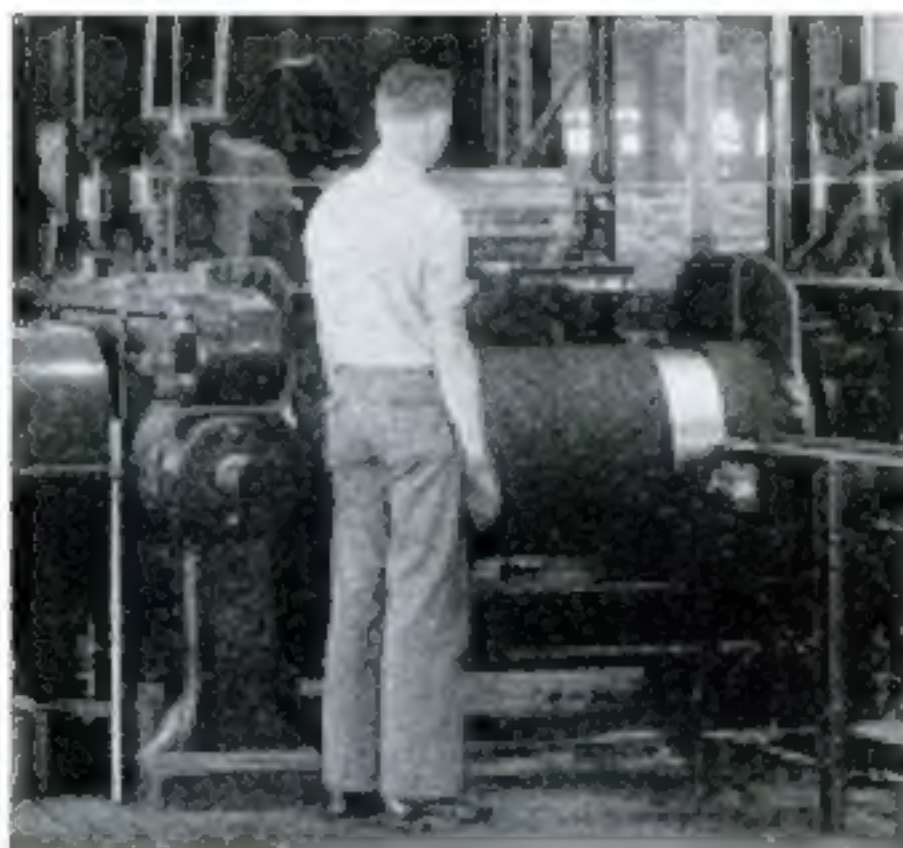
case plant. Every step in their production reveals the extreme care Delco-Remy takes to assure the *best* in battery construction. Consider a few of these steps:

The rubber "mix" is thoroughly kneaded for extra strength and resiliency.

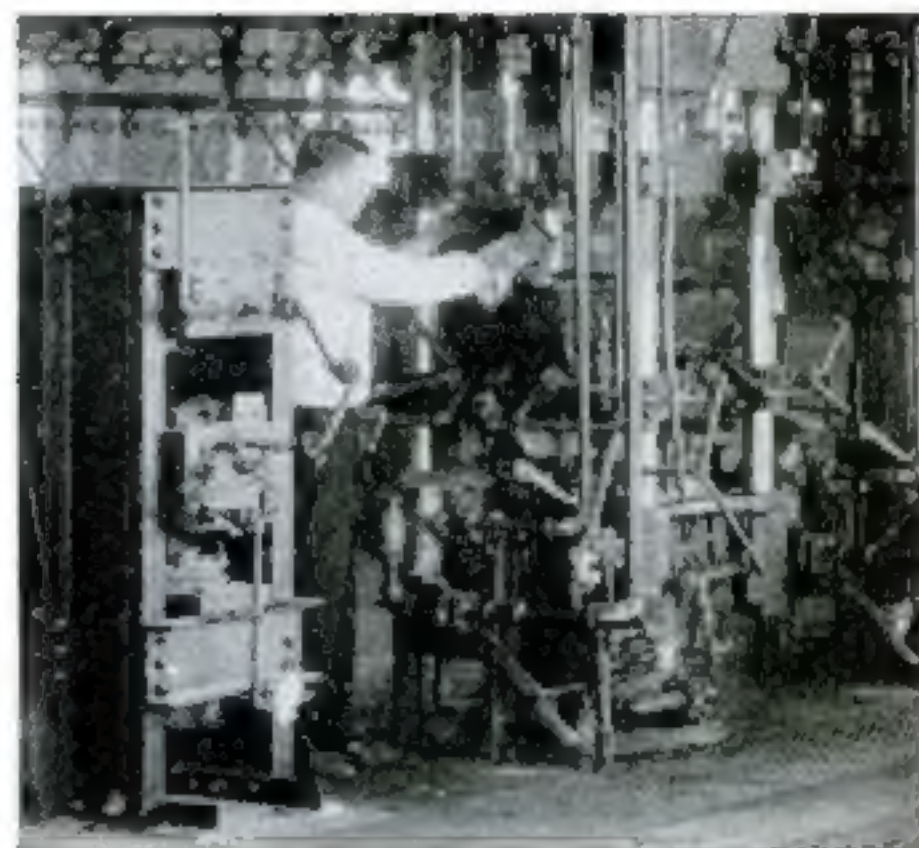
All rubber is carefully weighed before being molded into the case, to assure the correct amount.

Each case is molded under carefully controlled heat conditions and cooled naturally over a form, to retain its exact dimensions.

Every case and every cell-to-cell partition receives a "dielectric" test of 24,000 volts, which will reveal the slightest defect.



RUBBER MILL



CASE MOLDING

It is this unwavering adherence to high standards in materials, construction and performance that has made Delco batteries original equipment in many leading motor cars, including all General Motors cars.

Delco battery sales and service requirements are available at United Motors Service Stations.



# Delco-Remy

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# OLD KING COLE WAS A SOUR OLD SOUL!



**HE CALLED FOR HIS PIPE**—and in it came. But nix on that stuff about "a king can do no wrong"! His Majesty smoked a stinko mixture *none* of his court could stand!



**IT KNOCKED 'EM OUT.** Every lord and lady went down—kerplunk! Except the jester. He could take it! He could dish it out too! He ups and says to the sour old soul:



**"I'M A FOOL** about most things, but if you'll clean that pipe, and switch to mild Sir Walter Raleigh, you'll discover a *much* more fragrant blend of fine, ripe burleys."



**"IT DOES SMELL GOOD!"** cried the king, after he lit a pipeful of Sir Walter. "Have the cashier give this jester half my kingdom, and get me another two-ounce tin!"

## Our Readers Say

(Continued from page 7)

highly vulnerable, and both depend on fuel to enable them to remain in absolute control. Yet neither could possibly be converted to the uses of the other.—D.F.T., Schenectady, N.Y.

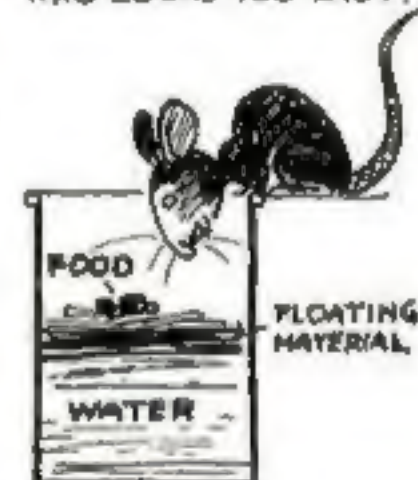
### —Or He Might Take Up Obstacle Racing

If I had a team of horses or a farm tractor I probably would not be writing this letter. Lacking these and a basic knowledge of horticulture, I thought one of your readers might help me solve a problem. There is a snowball bush in my back yard right where I want to put a badminton court. The bush is about ten feet tall and presumably has a goodly set of deep-growing roots. To move it would mean cutting a much bigger chunk of soil than could be conveniently dragged, and yet to cut the roots would undoubtedly kill the bush. Nothing short of an earthquake seems to offer any solution to the problem. Can any one tell me whether I should trim the bush and roots to a convenient size for transplanting, or leave it alone and take up golf?—C.P.T., Montclair, N.J.

### A Simple Trap for Catching Rats

IN YOUR February issue, the article on "Man Vs. Rats" interested me very much, and I would like to tell you of my experience. I tried all kinds of poisons and traps with very little success. Then I remembered how we used to get them on the farm. A bucket half full of water is placed beside a box of about the same height to serve as a platform. Straw, cork, or other floating material is then placed on the surface of the water. Scraps of fatty meat are dropped in as bait, which lies on top of the floating material. Place the box and the bucket side by side. The rodent smells the bait, jumps up on the box, drops into the bucket for a meal and—good-by Mr. Rat. I drowned eleven rats in one night with this method, which is cheap and therefore worth trying. Perhaps others will be interested.—C.F., Alexandria Bay, N.Y.

THIS LOOKS TOO EASY!



### Article on One-Piece Rails Was Clear to Him

REGARDING the question raised by M.A.L., of East Orange, N.J., about how the one-piece rails are put down on a roadbed where no track existed before, I interpreted the article in the February issue to mean that the train rode over the newly laid tracks. At least one of the pictures shows the engine pushing the train ahead of it. From the cars which go first, the rails can be removed and laid on the roadbed to provide tracks for the on-coming train. As a matter of fact, the text says quite plainly that "As the final step, any desired number of these sections are fused together with thermit or chemical welds during the operation

(Continued on page 9)

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(Continued from page 8)

of laying them." That's clear enough for me.—C.B.A., Esterly, Pa.

### Reader Gives a Big Hand to the Little Improvements

RUMMAGING through my attic the other day, I came across an old electric plug of porcelain. The thing looked so antiquated that it started me thinking. Do many of us realize how radically styles have been changing, during the last few decades, in all the little things that touch our daily lives—or are they overshadowed by the big inventions such as radio, airplanes, and automobiles? It might be fun to get together a museum exhibit of modern appurtenances of everyday life and the old-fashioned things they replace. I'd nominate: Gummed-paper tape for string, in wrapping packages. Screw caps for bottle corks. Slide fasteners for hooks and eyes or buttons. Beer cans for bottles. Chromium for nickel and brass. And, of course, for paper and what have you, a certain well-known transparent material that practically everything but the Brooklyn Bridge has now been wrapped in. Any other suggestions?—P.H., New York City.

BET YOU CAN'T FIND A MODERN SUBSTITUTE FOR THE OLD COAT SPRING!



### He Probably Would Answer to Just "Hey!"

IN "The Man with the Net," in the December issue, there is an item saying that average boys have three nicknames. Well, what do you think of this? I have nine nicknames. They are Peanuts, Shanghai, Pinochles, Springy, Pygmy, Tor, Breeze, Vishy, and Fish.—V.J.V., Calgary, Alberta, Canada.

### These Traffic Lights Would Help You Start Stopping

AN OBJECTIONABLE feature of the two-color traffic-light systems is that motorists and pedestrians have no definite means of telling how soon such a system is going to make a change. Drivers don't know whether they will be able to "make" an intersection before the lights turn red. Many find out too late, with resultant jamming on of brakes and occasional fender clashing. My idea is to install master rheostats that would dim the green lights gradually on a thoroughfare, thus informing motorists of the coming change before it is too late. There would be less chance of a motorist losing track of the lights altogether as he does, for example, in a city like New York where, on some streets, traffic lights are definitely out between changes. Here, also, the motorist becomes confused by the many red storefront signs. Halted traffic would be allowed to start when the gradually brightening lights reached full intensity, which could be signified by means of a single stroke of a small bell.—A.V., New York City.

SO WHAT? WE TRIED AN AMBER LIGHT WITH RED AND GREEN!



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## ENTERED NEW FIELD THROUGH HOME STUDY

THERE was no high school in my boyhood home town, and no money in our home to send me to the high schools of our nearest large city, St. Louis. Even as an "eighth-grader" I was fond of writing. However, when an opportunity came to attend a private manual-training school on a scholarship, I accepted it. Logically, upon completion of the four-year course, I entered the field of engineering, as a draftsman.

For seven years I worked for various industrial firms at the one type of work for which I was trained. It required only one or two of those years to convince me that I would never be happy as an engineer. Constantly, my thoughts were about writing—particularly the writing of advertising, mercenary chap that I was. Some day, when I managed to save a bit of money, I would take a college or a correspondence course. But there were always home responsibilities, and the savings just never seemed to accumulate.

In the meantime I married a successful business girl. To her I confided, in time, that I was unhappy as a draftsman and shop-production man. "Some-day," I told her, "I'm going to take a correspondence course (I had given up the college idea by then) in advertising." "Fine," she replied. "Why not enroll when you go down town tomorrow?"

I looked aghast. My income was barely enough to pay the rent and buy food. But wives can be determined—and can possess enough faith to compensate for the lack of determination in a fearful spouse. I enrolled in the advertising course of the ——— School, on the deferred-payment plan involving the smallest monthly payments. Without formal enrollment, I also began the home study of typing, with my wife as most competent instructor.

Within nine months I had reached the halfway mark in my course and decided to begin looking for a place to apply my new training—most thorough training, I may add. Through the local ———

School office, I learned that the advertising manager of the ———

Co. required an assistant. I applied and was employed. My ———

School training was of immeasurable benefit in helping me carry on my work, but, needless to say, I did plenty of additional learning on the job. So excellent was my advertising grounding that five months later, when the advertising manager resigned, I was appointed his successor.

In the meantime I continued my course, finding ample opportunity to ap-

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## Secrets of Success

ply the training. Then came the depression of 1920. The company decided to discontinue advertising—and the services of the entire advertising department. Now came the crucial test of my training. Could I apply advertising to secure a new connection? I could. Within two weeks I was a member of the copy staff of the ——— Advertising Agency at increased salary—the result, primarily, of a sales-letter campaign.

Sometimes my days were busy, and for weeks my uncompleted course lay on my table. Ultimately, however, I completed it. Several years later I received an invitation to join the advertising department of the ——— Co. Thanks to the comprehensive course prepared by ——— School, I was able successfully to handle a myriad of problems covering almost every phase of advertising—direct-mail, farm-paper advertising, outdoor advertising, newspaper advertising, and so on.

I became particularly interested in dealer merchandising. Feeling the need of more training along this line, I took the ——— School course in merchandising, which has been tremendously helpful ever since.

So far I have said nothing about income, because that has meant less to me than the fact that I have been extremely happy in my work. However, my income has been well above average—and still is. Of greatest personal satisfaction is the fact that I have "made good" in every advertising position I have held, and have been able to gratify my desire to write. Not only have I written reams and reams of copy, but also hundreds of trade-paper articles, and several books on merchandising.

Once upon a time it was quite customary to ridicule the idea of correspondence courses. But those who laughed had never taken such a course. I have proved, personally, that the last laugh belongs to those conscientious individuals who really put time and effort into home-study courses, for they are bound to get profit and pleasure out of them.—F. H. M., *Elmhurst, N. Y.*

## DRAFTSMANSHIP GOAL SEEMED HOPELESS

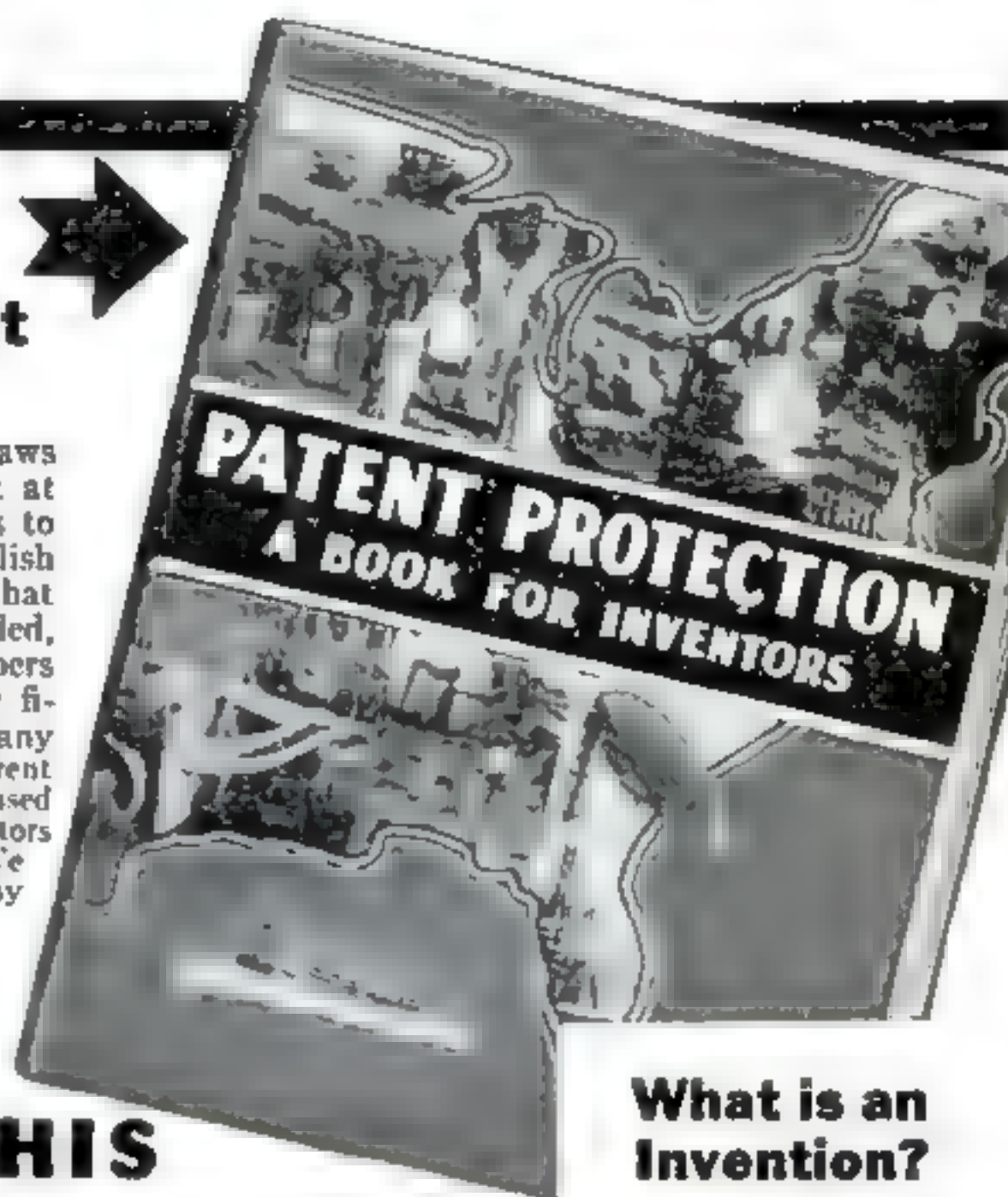
I CANNOT overestimate the benefits received from studying mechanical drafting with the ——— School. I left high school at the tender age of seventeen, because it didn't appeal to me. I wanted to find work in the mechanical field. Unfortunately, there were no positions available in that field, so I accepted a position as a glass grinder with the ——— Co. After working there for about a year, a fellow employee informed me that the owner of the ——— Garage wanted a young man with mechanical ability to work in his establishment.

That same evening, I inquired about the position, obtained it, and a week later left my old position for the new work. This job held my interest for a

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## Secrets of Success

two, was given to us to use. I had two assistants.

I did not know so many parents were yearning for kindergarten work for their children. In this town of 2,000, there was no kindergarten in connection with the public schools.

A dependable girl called for the children every morning with her car and delivered them safely home at noon. If you had passed near the kindergarten any morning, you would have heard eager little voices singing national anthems and southern folk songs. If you were tempted to enter, you would have watched them march to music every half hour to their next classes. I saw timid little ones develop initiative; too-bold ones become subdued. Every pupil was taught initiative, self-help, and recognition of the rights of others, during the early formative period.

Home study brought happiness to our home. The search for happiness is presumed to be the chief purpose of life. To many this may mean social success—to most it means healthy effort in daily work, with its resulting material success. For guidance received from this correspondence course, I am grateful. It led me to happiness and service.—Mrs. H. L., Seneca, Kans.

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THREE prize-winning letters in POPULAR SCIENCE MONTHLY'S Secrets of Success contest—"What Home Study Has Meant to Me"—are printed above. Read these stories carefully, because your own career may be just as interesting and inspiring to other readers. If you think so, put it down on paper and send it in. We will pay \$5 for every letter we publish.

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Only letters from bona fide home-study school students will be considered and these must contain the name of the school and the name of the company, or companies, for which you have worked since graduation. (Names, however, will be deleted from the letters when published.) We also want to know the kind of course you took and the type of position you have held. Your own identity will be kept anonymous, if desired.

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# Are YOU a Business Coward?

—and—does it show in your pay-check?

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"Merwin was only a bookkeeper then, you remember, but in his spare time he was studying Higher Accountancy. I knew what he was doing, and I told you then to keep your eye on Merwin.

"He's had three raises since. He has more than doubled his salary—and he earns every dollar I pay him.

"Last week I recommended him for Assistant Treasurer, and the Board elected him without a dissenting vote. We're mighty glad to have him in the group.

"But you, Jarvis—I hate to say it—you're a business coward. You knew

what you would have to do to get out of the small-pay class. You were simply afraid to face the kind of effort and responsibility that could get you a substantial salary.

"And now it's too late. We've got to cut our overhead, and you're one of about fifty men that we can get along without. We could replace the lot of you tomorrow.

"For your own sake, Jarvis, take a tip from a man who has been through the mill, and this time get busy and learn to do something better than the other fellow.

"Jarvis, there's no end of opportunity in business; but the only man who cashes in these days is the man with the courage to get special training. The offices of this country are simply cluttered up with business cowards. It's easy for the man who *trains*—because the business coward is through before he starts."

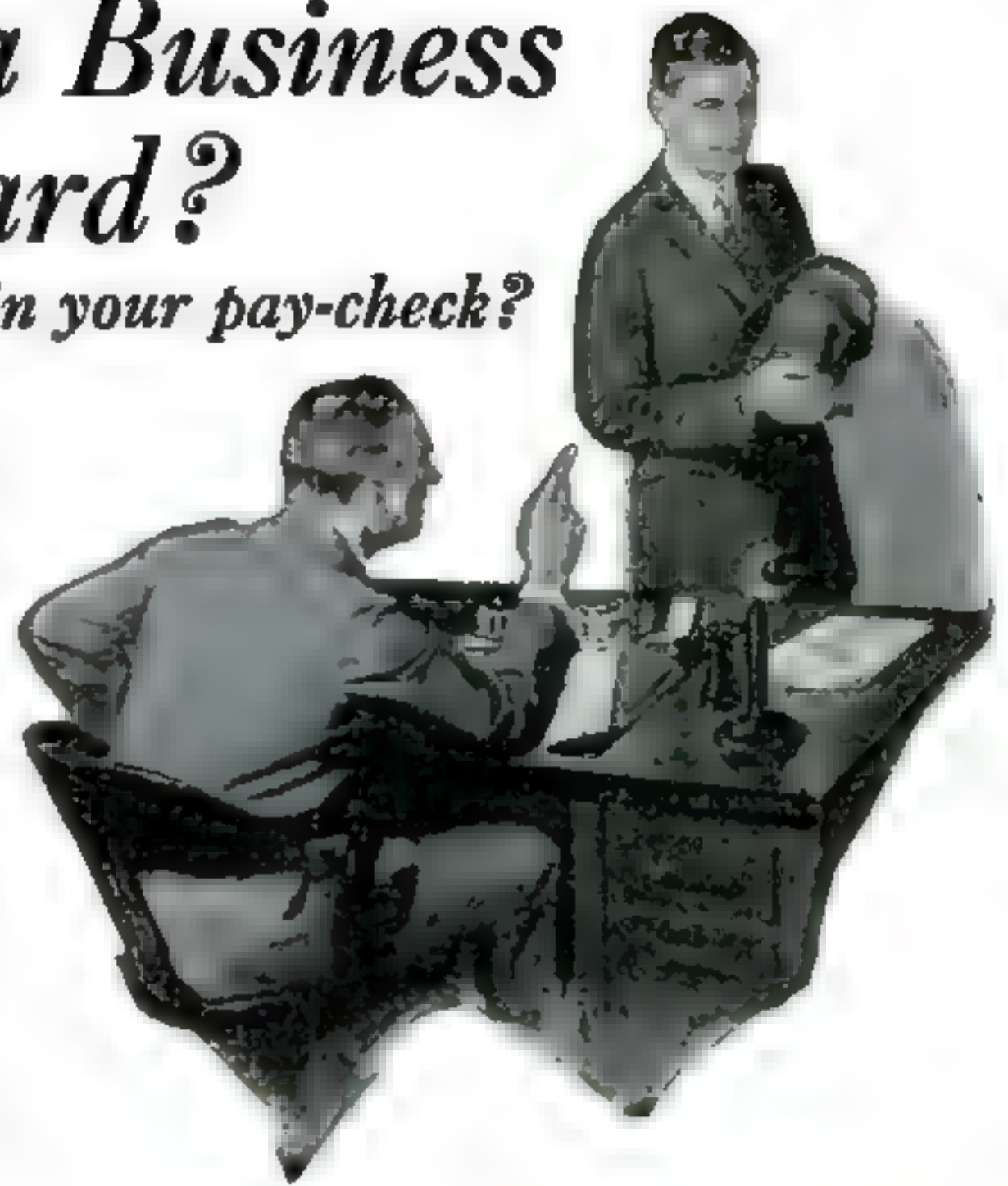
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Are YOU one of several million routine men who have been drifting along in a "low-pay" job—always wishing for more money, never acting?

Are YOU a business coward?

Nearly a million ambitious men have asked themselves this question during the past thirty years—and replied with a ringing "NO!"

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achievement under the "LaSalle Problem Method," is one of the most thrilling chapters in the romance of business.

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# Handy Aids for Home Mechanics

## Window Frames of Cast Concrete



How the sturdy concrete frame is built into a wall

SUITABLE for either remodeling work or new-home construction, a unique window frame made of precast, reinforced concrete is now available for installation in brick, stone, concrete, concrete-block, and stucco walls. Metal inserts built into the frames receive brass screws for fixing steel sashes in position, and permit easy removal of the windows for painting. Brass-lined channels on the inside and outside of the frames provide "tracks" for Venetian blinds and storm shutters. When not in use, the storm shutters slide back, like the top of a roll-top desk, into a space provided at the top of the frame. The frames, which are completely water-tight, are available in standard sizes, facilitating the work of the builder to speed construction operations and to cut down on building costs.

## Wall Insulation Has Built-In Spacers

IN A NEW, improved type of insulating material just placed on the market, special spacer flanges built into the material insure adequate air spaces between the insulation and the walls, ceilings, and floors, and eliminate the need of lathing. In use, the spacer flanges, which edge the insulating material on both sides, are fitted over adjacent studs, joists, or rafters and nailed or stapled in place, as shown in the photograph at the right.



The spacer flange being attached to a stud

## Portable Electric Mixer Aids Painters



Stirring in paint with the portable mixer

RESEMBLING a food mixer for the kitchen, a new portable electric paint mixer makes it easy to blend colors for special jobs. The mixer, which consists of a powerful motor and twin mixing blades, can be clamped easily to the rim of an ordinary large-size paint can.

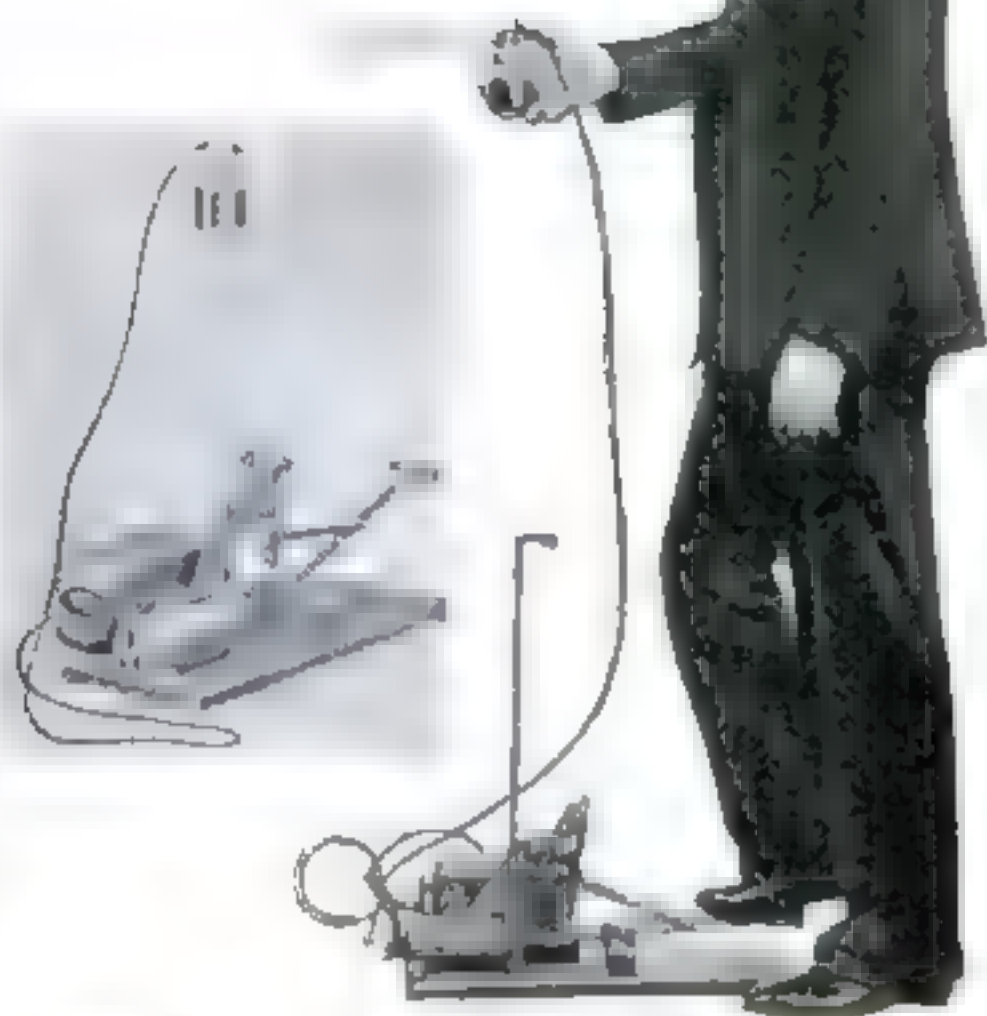
## Tape Splits Lamp Cord

RUBBER-COATED electric-lamp cord of new design is easily split into its two strands by simply pulling a "tape" encased between the wires, as shown at the right.

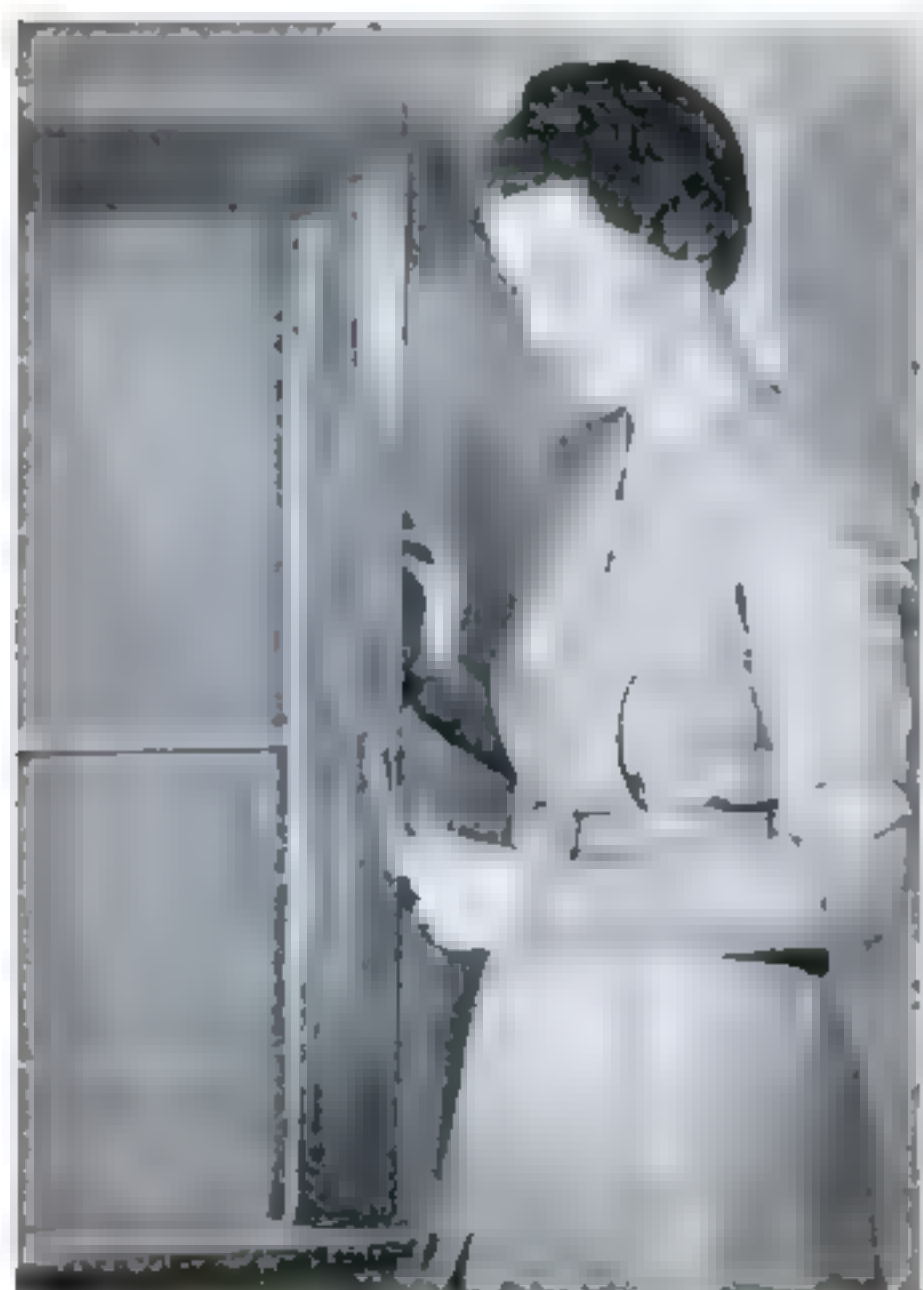




## Spray Gun Works by Foot Lever



WEIGHING less than ten pounds, a liquid-spray gun powered by a simple foot-operated pump to supply compressed air is now available for spraying paint, insecticide, and other fluids. A foot pedal works a pump feeding air into a small storage tank. Automatic valves then release the air at a uniform pressure through a flexible hose leading to the spray gun.



## Cranks Set In Casement Open Novel Windows

OPENED and shut by means of a crank set in the casement, a new window offered to home owners operates on the principle of the conventional automobile window. Turning the ornamental crank slides the panes of glass up or down, without moving the sash. A special strip, shown in the illustration above, forms a seal between the upper and the lower panes, preventing drafts when the panes are closed.

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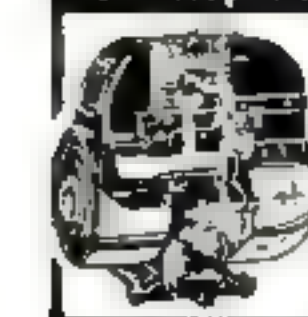
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## Transformer Steps Up House-Current Voltage

HAVING three different voltage taps, a new booster transformer is designed to raise deficient house-current voltage to the point where it will operate household appliances at their proper rate and efficiency. In districts where the voltage is below normal, the transformer may be tapped at 100, 115, or 125 volts, according to the requirement specified by the manufacturer's rating tag on the refrigerator motor or other electrical device.

## Questions FROM HOME OWNERS

Q.—Our window screens are riddled with a number of tiny holes. What is the best way to patch the screens, at least for the time being?—H.L.Y., Lexington, Ky.

A.—IF THE holes are very numerous, it would be best to buy good screening and recover the frames. However, if you do not want to go to that expense, you can secure a spool of wire of the same dimensions as the screen wire and then "darn" the holes by weaving the wire back and forth to form a patch of the same mesh as the screen. Another method is to fit a section cut from an old screen over the hole and wire it securely in place. An easy way to do this is to fray the edges of the patch, then bend the end wires of the patch into the old screen to hold it firmly.

## Bran Cleans Bearskin Rugs

B. N., TACOMA, WASH. A good way to clean a bearskin rug before storing it away for the summer is to apply hot roasted bran, rubbing it all through the fur. Let it remain in the rug for about an hour or so, and then brush it out.

## Frosting a Bathroom Window

Q.—IS THERE an inexpensive way to frost the plate-glass window of our bathroom to make it nontransparent?—K.D.L., Wichita, Kans.

A.—MAKE a solution by mixing a tablespoonful of well-ground whiting with two or three quarts of milk. Apply  
(Continued on page 17)

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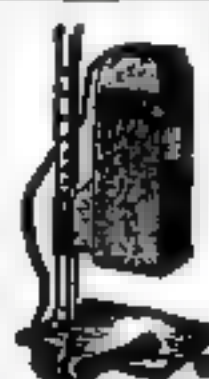
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## Questions from Home Owners

(Continued from page 15)

this to the glass with a paint brush, and then stipple the surface with a dry, soft brush. Another method is to mix sugar of lead with varnish, and apply it in the same manner outlined above.

### Repairing Veneer

S. N., TROY, N.Y. In replacing veneer, do not apply the glue to the veneer. Apply it to the board only. Then put the veneer in place and clamp the pieces together as quickly as possible.

### Tree-Cement Formula

Q.—CAN you give me a good formula for a tree cement to patch up the trunk where a branch has been torn away?—B.D., Chattanooga, Tenn.

A.—BIND the fracture with a cement made by melting ten parts of pitch and adding, successively, one part of turpentine, two parts of tallow, and one part of methylated spirits—ordinary alcohol which has been denatured with methyl alcohol.

### Making Glue Flexible

J. O'D., MALDEN, MASS. Adding one part of glycerine to four parts of ordinary glue may help to make the adhesive flexible.

### Attaching Window Boxes

R. K. G., BUFFALO, N. Y. When attaching window boxes to the wall of a concrete house, you must first obtain a surface into which you can nail the wooden frames. Using a hammer and cold chisel, cut holes in the concrete at the point where nails will enter the wall. Plug the holes with wooden pegs driven in with a hammer. It is then an easy matter to drive nails through the window-box frame into the wooden plugs.

### Grass-Seed Requirements

V. A. K., DAYTON, OHIO. About one pound of grass seed should be used to sow each 300 square feet of lawn. Sow the seed on a windless day, scattering it as evenly as possible. It is a good idea to seed the ground twice, walking first in one direction and then retracing your steps. Use a fine spray from your hose to water the soil so that you do not displace the seeds.

### Test for Hard Water

G. B. L., OMAHA, NEBR. You can test water for hardness by adding a few drops of a solution of soap and alcohol. If the water is hard, the mixture will cause white flakes to form in the water. Soft water, however, will remain clear.

### Paint in Good Weather

T. F., CLINTON, IND. Do not paint outdoors in frosty, damp, or any kind of unfavorable weather.



TOMMY LOUGHRAN

Undeclared World Champion. Photo taken Feb., 1938

## A WORLD CHAMPION

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## Build A Powerful Body

THE SECRET'S OUT: Well, fellows—here's the lowdown. Don't think I always had this swell physique—and don't think it just naturally grew on me. When I first started boxing, I was tipped off that a champion must be able to take it—as well as dish it out. The fighting game is hardly a ping-pong contest. You have to meet human gorillas. To swap punches for twelve and fifteen rounds requires an enormous amount of energy and stamina—That is why it was necessary for me to first build up a sturdy body before I could ever amount to anything as a fighter. And that is just what I did.

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It took me years of study and research—also thousands of dollars to acquire this knowledge of building muscles which possessed the power of an ox, but the speed and agility of a panther. These are the only type of muscles which enable you to engage in active sports or to really accomplish anything. It was not long until I was receiving offers galore, if I would only impart this knowledge and train others through this short but certain method of body building. Days were all too short to satisfy the demands on my time. I decided to have duplicates made of my apparatus and put the instructions into printed form. In this way I am now enabled to spread the joyful message to the world.

### Send for My FREE Book "Puissant Body Building"

This contains numerous photos of the athletes and strong men I have trained. It will be an impetus and an inspiration to you. I don't ask you to buy it. I want to spread the glad news. It is absolutely free. Yours to keep.

Don't delay. This does not obligate you in any way whatever. It is merely an inspirational talk and will show what I have done for so many others.

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### TOMMY LOUGHRAN

Dept. 50 4 So. 15th Street, Philadelphia, Pa.

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## Scientist Says Heads Grow Through Life

RECORDS he kept for forty years of the sizes of the hats he bought and wore have convinced Sir Flinders Petrie, eighty-four-year-old British archaeologist, that his head diameter increased steadily, even past middle age. The British scientist made known his findings in a letter to the Smithsonian Institution, at Washington, D.C., in confirmation of a theory recently advanced

by Dr. Ales Hrdlicka that the human head—and presumably the brain—grows throughout adult life. Sir Flinders reported that when he was twenty he wore a size 6 1/2 hat. Ten years later a size 7 was too small. At forty, he bought size 7 1/4, and at fifty, a size 7 1/2. Since then, he has had difficulty wearing any standard-size hat, the scientist declares.

## Atom-Smashing Creates New Atomic Forms

TRANSMUTATION of the elements, or "atom-smashing," has added more than 220 kinds of atoms to the basic 250 found in nature, according to Dr. K. K. Darrow of the Bell Telephone Laboratories. Moreover, only two chemical elements have resisted scientific efforts to break them down into different

atomic structures. Before the days of atom-smashing, the world consisted of 250 kinds of atoms, of which about forty were unstable like radium, which spontaneously disintegrates into other forms. In the last four years, scientists produced almost all the unstable forms capable of lasting a few seconds.

## Wartime Power Plants Are Made Bombproof

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## Monastery Secrets

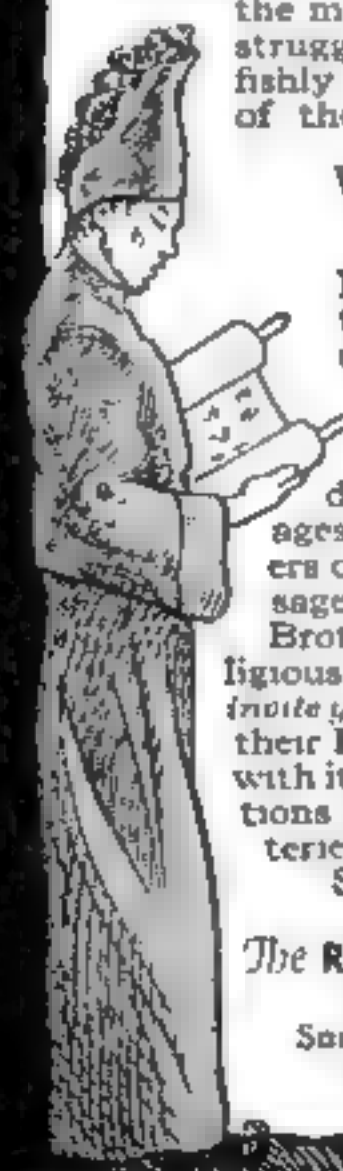
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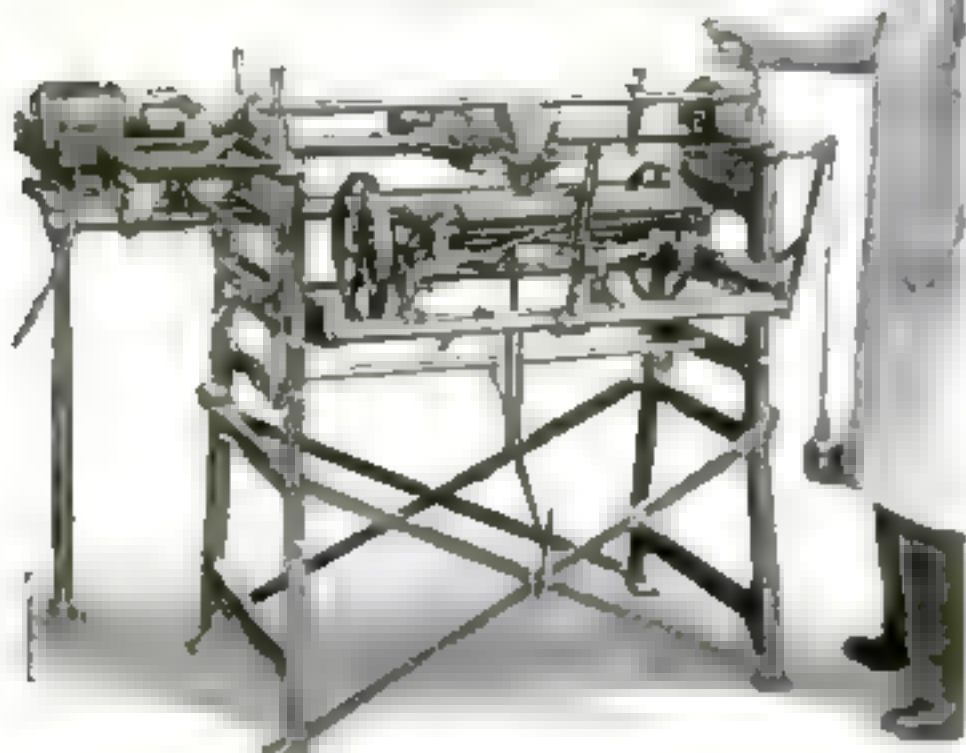
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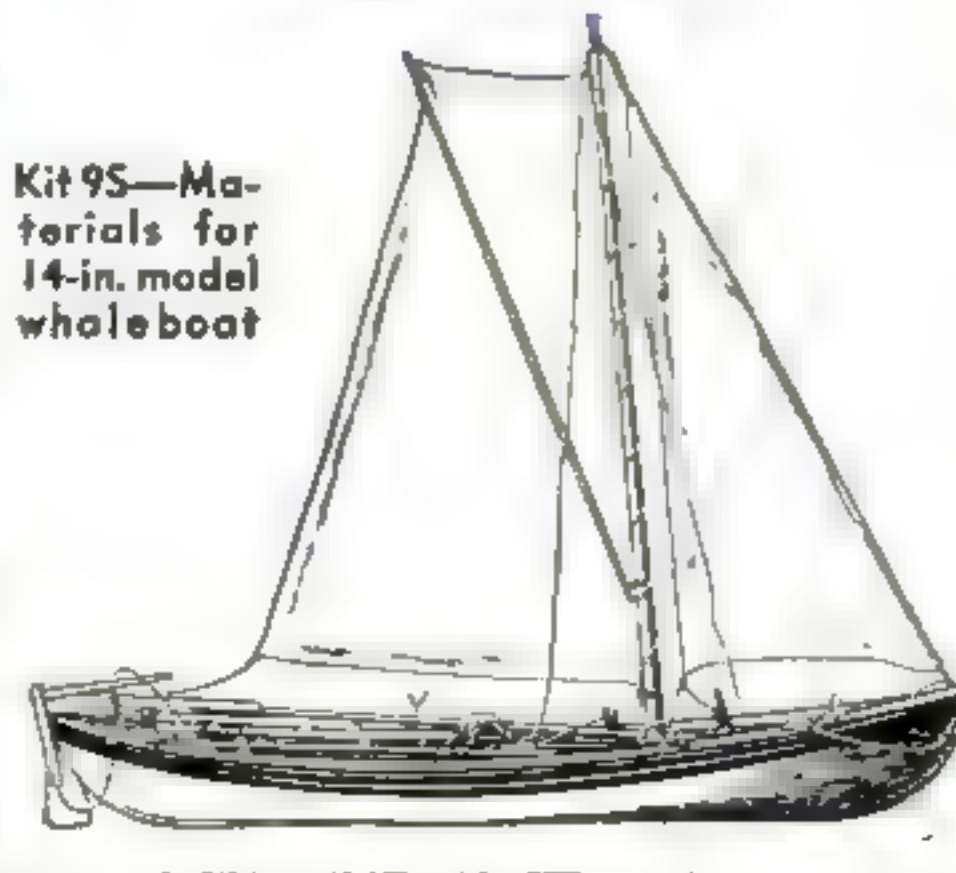
Each kit in the following list contains all the raw materials for making the model named. A certain amount of preliminary shaping has been done on most of the hulls or hull lifts, and the other materials are of such sizes and shapes as to make it easiest for you to transform them into their final form. Full-size blueprints, as well as any necessary instructions, are included.

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- Q. Privateer *Swallow*, 12½-in. hull, 20 in. over all. . . . . 4.95†
- V. Clipper *Sovereign of the Seas*, 20½-in. hull, 26 in. over all. . . . . 4.95†

(Continued on page 23)

Kit 9S—Ma-  
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14-in. model  
whaleboat



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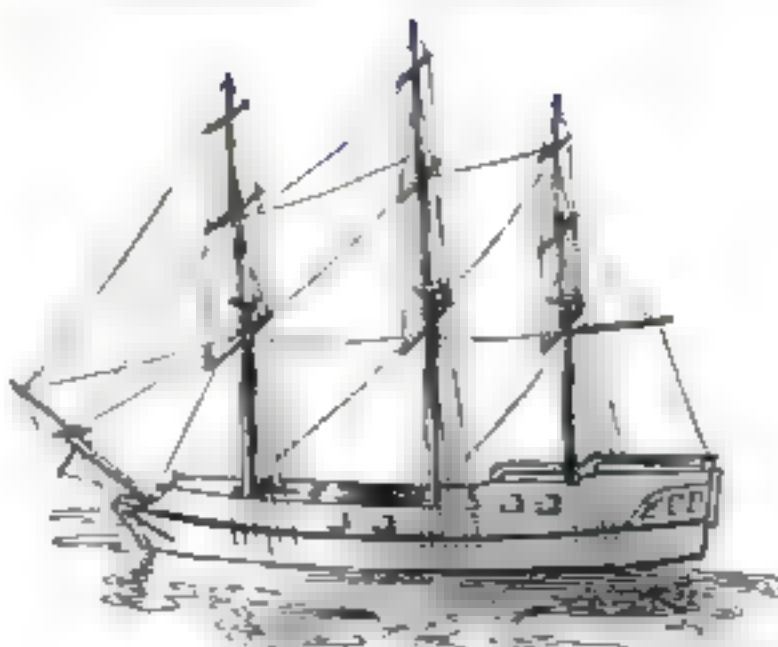
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## Kits for Making Models

(Continued from page 22)



Kit U—"Hispaniola" of "Treasure Island"

- Y. Trading schooner, 17 1/2-in hull, 22 1/2 in. over all 4.90†
- 2S. U. S. Navy destroyer *Preston*, 31 1/2-in. hull 5.95\*
- 3S. *Constitution* ("Old Ironsides"), 21-in. hull, 31 in. over all 6.50\*
- 4S. Clipper ship *Great Republic*, 31 1/2-in. hull, 42 in. over all 8.40\*
- 5S. Coast Guard patrol boat of new 165-ft. class, 20 5/8-in. hull 4.95\*
- 6S. Brig *Malek Adhel*, 1/4-in. scale, 20-in. hull, 33 in. over all, frame-and-plank construction 9.75†
- 8S. Fishing Schooner *Bluenose*, 17 1/2-in. hull, 22 in. over all 4.95†
- 9S. Whaleboat, 14 in. long; partly shaped hull and raw materials for making all equipment 2.75†
- 10S. Confederate raider *Alabama*; steam sloop, bark rigged; 3/32-in. scale; 21 1/2-in. hull, 28 in. over all 8.20\*

### MODEL-OF-THE-MONTH KITS

- M. Aircraft carrier *Saratoga*, 18-in. 1.00
- N. Four U.S. destroyers, each 6 1/4-in. .75
- R. U. S. cruiser *Tuscaloosa*, 11 1/4-in. 1.00
- U. *Hispaniola*, the ship in "Treasure Island," 7-in. .50
- Z. H.M.S. *Bounty*, 11 1/2-in. 1.50
- 2M. Ocean freighter, 14-in. 1.50
- 3M. Yacht *Nourmahal*, 8 1/4-in. 1.00
- 4M. Oil tanker, 14-in. 1.50
- 5M. Liner *President Lincoln*, 14 1/4-in. 1.50

### SIMPLIFIED SHIP MODEL KITS

- F. Liner S.S. *Manhattan*, 12-in. 1.00
- H. Cruiser U.S.S. *Indianapolis*, 12-in. 1.50
- J. Clipper ship *Sea Witch*, 13-in. 1.50

(Continued on page 24)



Our new model of the famous Confederate raider "Alabama" is built with Kit 10S

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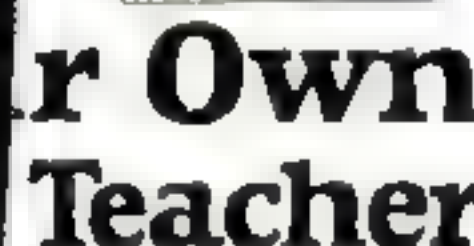
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POPULAR SCIENCE MONTHLY

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## New Studies Double Oceans' Estimated Age

DOUBLING their estimates of the age of the oceans, geologists now declare that the vast bodies of salt water that make up a large portion of the surface of the earth have existed for between 500,000,000 and 700,000,000 years. Moreover, they see a possibility that earlier oceans may have existed long before our present ones came into being.

During the last century, geologists first measured the oceans' age by dividing the amount of salt in them by the amount known to be added each year by rivers. This figure was approximately 100,000,000 years. It was based on the assumption that all salt brought to the oceans by rivers remained in them in solution. Later research corrected the figure according to the same reasoning to make the estimated age of the oceans 350,000,000 years. But even this figure was found to be too small. Studying the action of sea-bottom clay on salt water, Dr. A. C. Spencer and Dr. K. J. Murata, of the U. S. Geological Survey, found that some of the salt carried to the oceans is removed by the clay and deposited on the sea floors as a compound that does not easily dissolve. Correcting the old figures for this salt removal gave them the new estimate of 500,000,000 to 700,000,000.

Even this may yet be found too small, according to geologists who are measuring the earth's age by the products of the decay of radioactive elements. They place the earth's age at 2,000,000,000 years or older. While the earth may have been oceanless at one time, there is in the earth's-age estimate plenty of room for earlier oceans than our present ones, it is pointed out.

## Meter Replaces Noses To Test Fresh Fish

AUTOMATICALLY testing the freshness of fish, a new electric meter developed by Dr. J. M. Lemon, of the U. S. Bureau of Fisheries, does away with the less certain methods of judging fish by their odor and "feel." In a recent demonstration before the Fish Advisory Committee of the Department of Commerce, at Washington, D. C., experts explained how the passage of a known electric current through a solution of fish proteins could be measured to show the degree of acidity of the solution. For the first twenty-four hours after a fish is caught, it was pointed out, the lactic acid content of the flesh increases. The higher the acid content, the more current flows through the solution. The novel meter records the current quantity, thus indicating how long the fish has been dead. Although the testing method at present is applicable only to fish that have been dead for periods of less than twenty-four hours, it is believed that the new method of testing will provide a rapid and accurate means by which fresh fish may be selected for commercial shipment into the interior of the nation.

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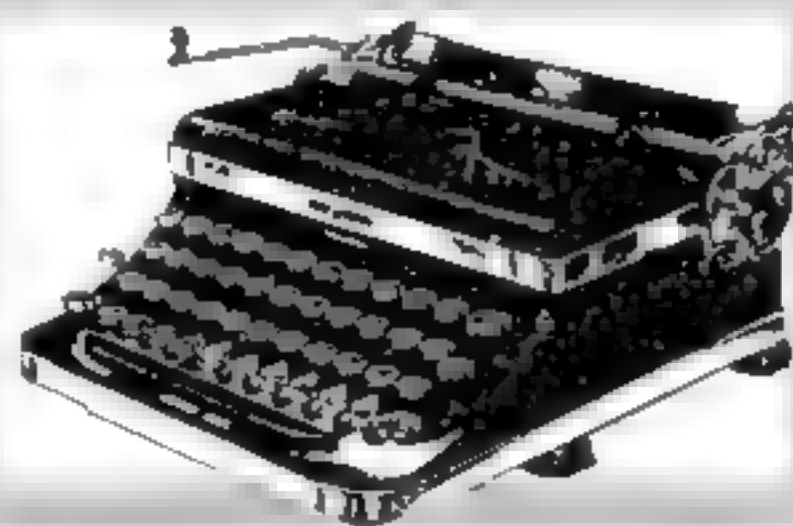
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(Below) When a disc goes through the Magnaflex test, even the slightest crack is revealed.



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# POPULAR SCIENCE

*Monthly*

RAYMOND J. BROWN, Editor



Clover-leaf intersections, like this one on the West Side Express Highway in New York City, will be a feature of tomorrow's highways

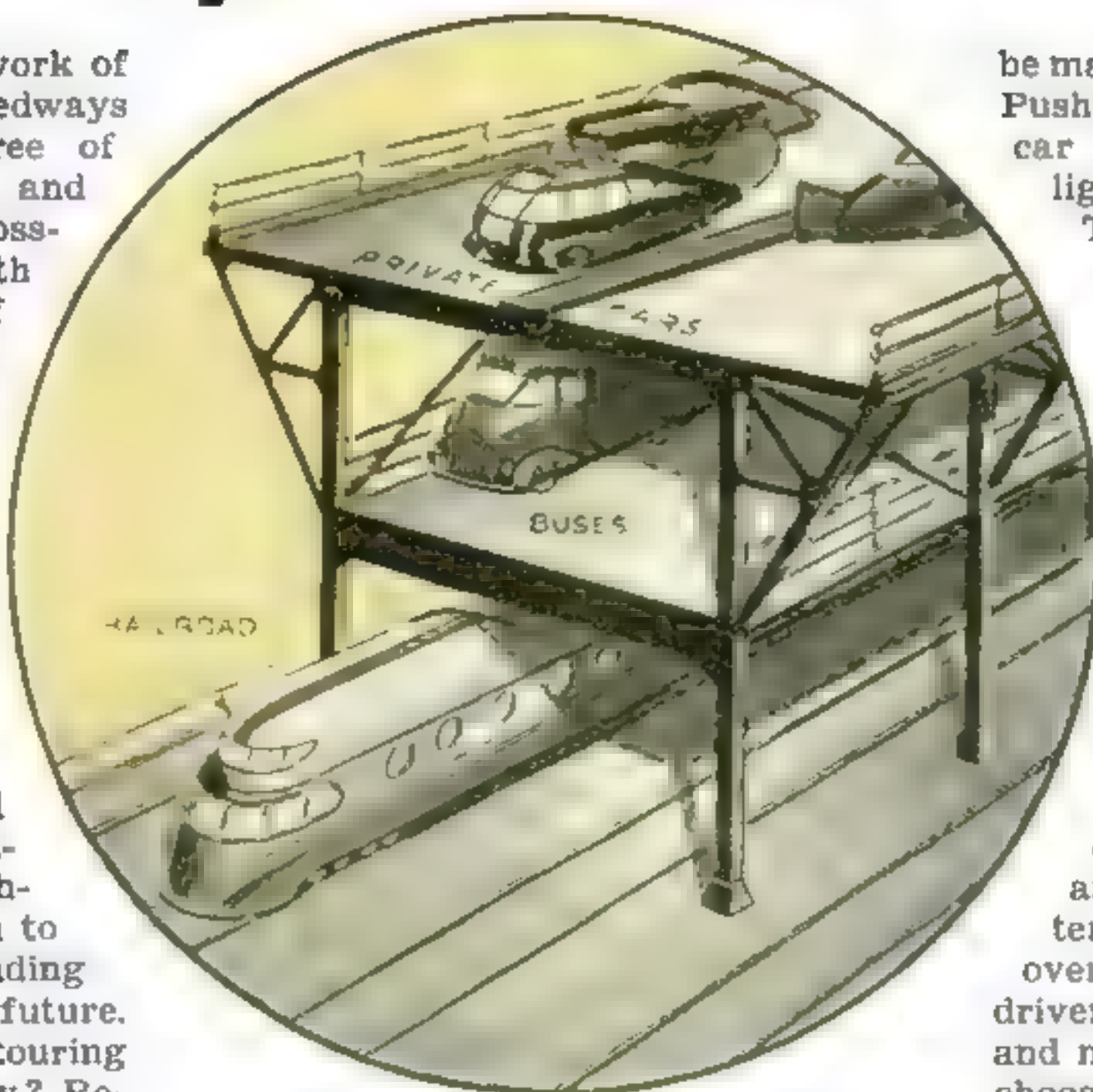
## Highways of the Future

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Requiring twenty-five years for completion, the mammoth gridiron of superhighways would change long-distance driving from a motorist's nightmare of snarled traffic into a reality of fast, safe transportation. It would represent an impressive start toward an era of scientifically constructed speedways, and crash-proof cars of radical new design to run upon them, foreseen by leading experts for the not-too-distant future.

What will transcontinental touring be like, say, fifty years from now? Recently Dr. Miller McClintock, director of the Harvard University Bureau for Street Traffic Research—the man who is recognized as the nation's foremost authority on traffic problems—gave a startling preview of the momentous changes he sees ahead.

Rear-end collisions, he foresees, will



In congested areas, double-deck roadways with separate levels for commercial and pleasure cars may be built over railroads

be made impossible by a new expedient. Pushing down the brake pedal on a car of the future will operate a stop light that emits infra-red rays. These invisible light rays, picked up and distinguished from ordinary light by a photo-electric cell on the front of a following car, will energize an electric circuit and apply its brakes automatically.

Electric cables, buried beneath the pavements of superhighways, will govern the movement of cars. One set of electromagnetic impulses will control the car's speed. Another set will lock its steering gear against any attempt to make a dangerous turn from one lane to another. Eventually, the cable system may even be adapted to take over steering altogether—allowing the driver to release the wheel, sit back, and make himself comfortable until he chooses to switch back again to manual control.

At night, the superhighways will light up of their own accord, section by section, as a car travels over them. "Electric eyes" spaced along the road will turn on the glareless illumination whenever a car passes, shutting it off at other times to conserve electricity.

By  
**E. W. MURTFELDT**



Imagine a typical section of this superhighway of the future. Straight as a shaft of light, ten or more broad lanes of concrete stretch across the countryside, passing around cities and towns, bridging railroads, canals, and crossroads. Streamline busses roar along a center strip that splits the speedway, separating streams of private cars traveling in both directions. For cars moving at different speeds, each one-way pavement is divided into separate safety, accelerating, cruising, and express lanes.

Hop into a 1988-model car and take an imaginary spin down one of these amazing foolproof roads. Perhaps you arrived at the transcontinental artery by plane, swooping down on one of the concrete flight strips lining the boulevard, or settling to an automatic, radio-controlled landing on a spacious airport built close to a major highway intersection.

Driving up the clover-leaf approach onto the elevated highway, you glide first into the slow-speed safety lane, edge over into the accelerating strip, and turn the steering wheel to swing into the cruising lane. But nothing happens. Your car refuses to respond

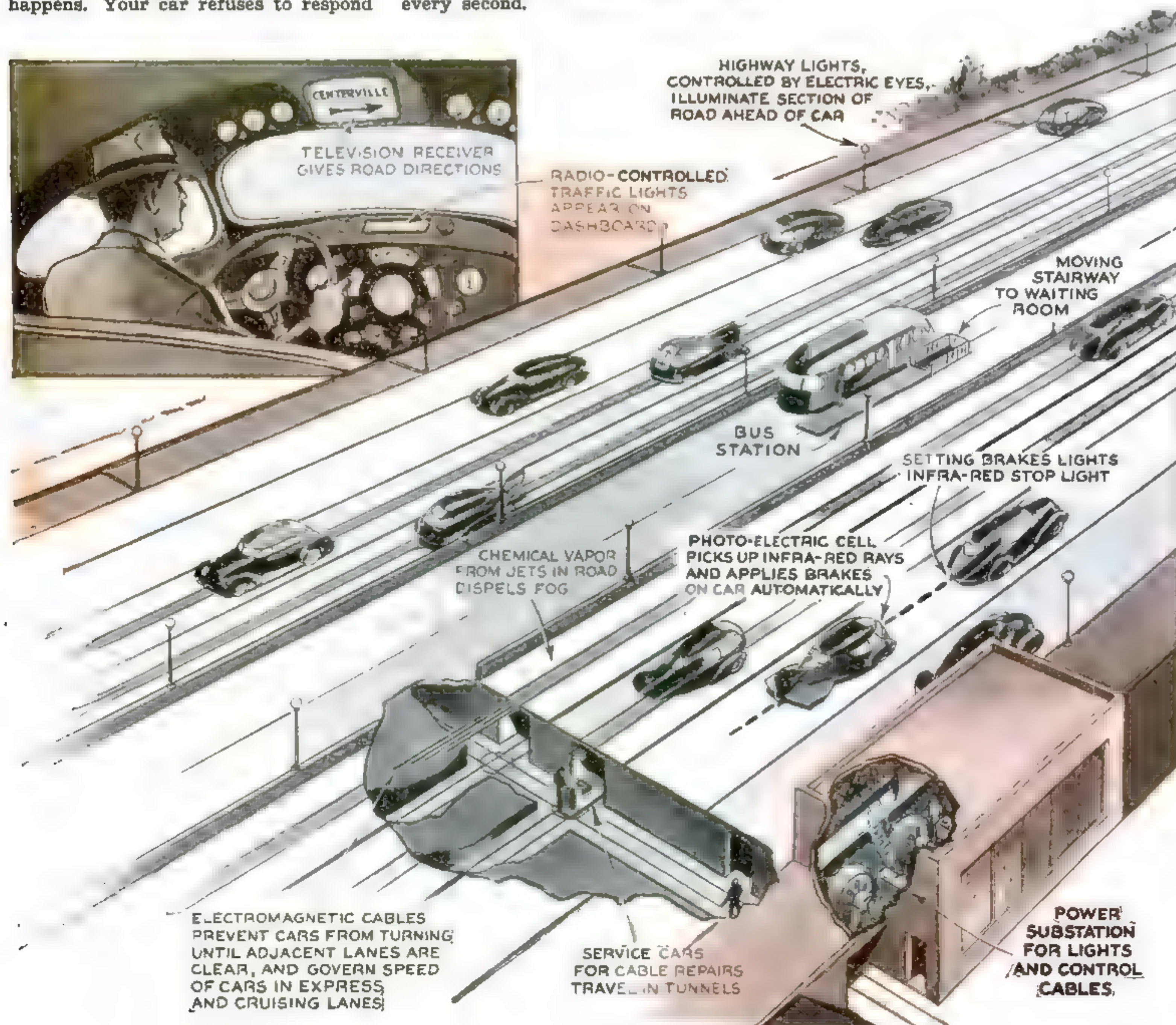
to the wheel, and suddenly you learn why as another automobile whips by on your left at sixty miles an hour. Suspended in service tunnels below the pavement, cables operating on an electromagnetic principle control a mechanism attached to the steering gear to prevent the car from turning left until the adjacent cruising lane is free from traffic for a safe distance.

You try the wheel again. This time the car swings over into the cruising lane and immediately picks up speed. You haven't stepped on the gas, but the speedometer needle creeps steadily upward and freezes on the sixty mark. A second set of buried electromagnetic cables is taking over control of your speed, since cars in the cruising lane must go no more and no less than sixty miles an hour.

But other automobiles are still flying past you on the express lane to your left. Now you swing the wheel over, confident that the car will respond only if turning is safe. In the express lane, your speed automatically steps up to the 100-mile-an-hour limit. Fifty yards of special nonskid pavement flies by underneath your car every second.

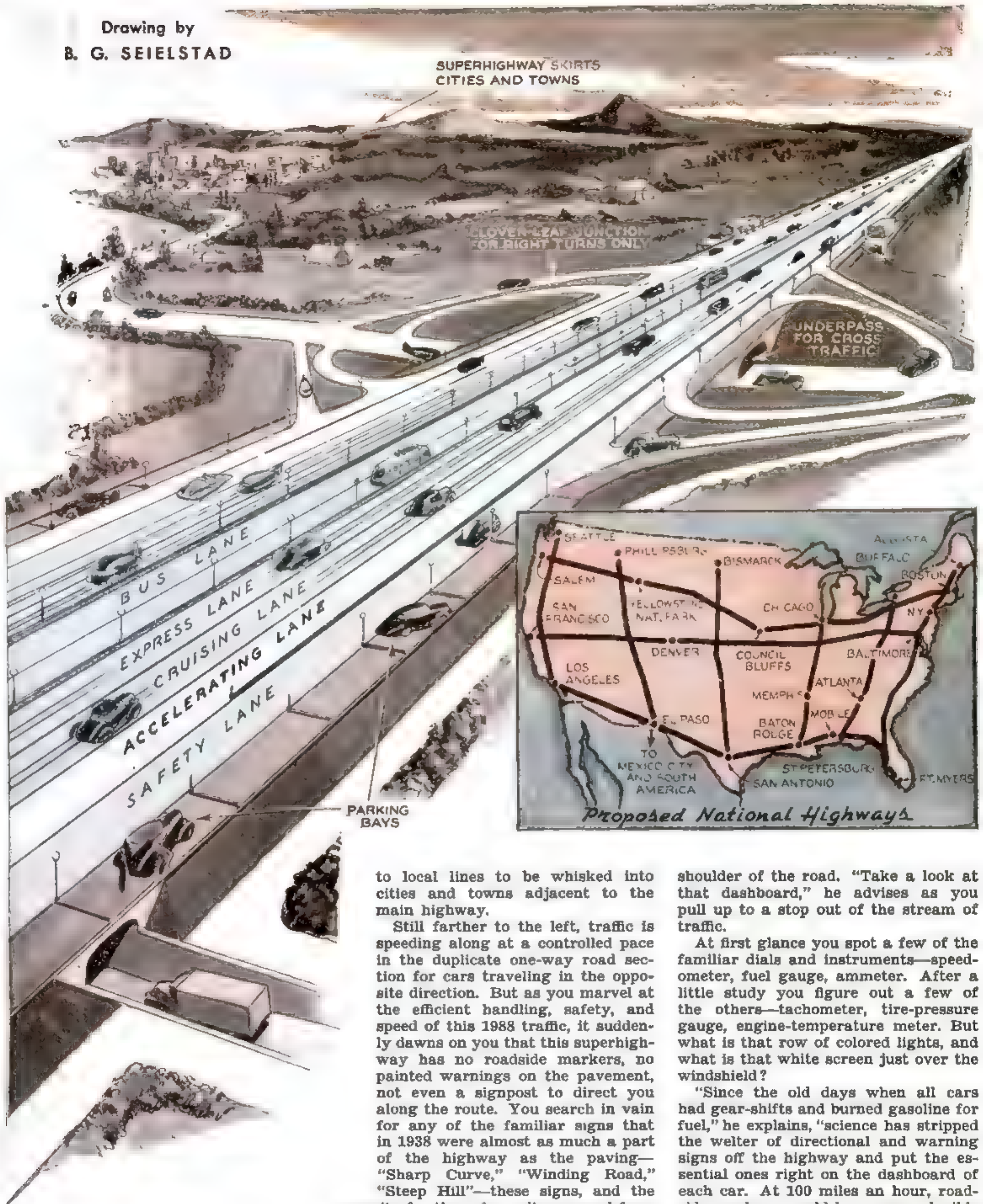
Unless you switch back to a slower lane, you can maintain that pace hour after hour, for you'll never see a traffic light, a railroad crossing, a street intersection, or even a curve sharp enough to slow you down. At twilight, overhead lamps will bathe the road in light. Sleet cannot form on the chemically coated windshield of the car. If you run into fog, chemical vapor escaping from tiny jets in the roadway will clear a lane of visibility. So your top speed of 100 miles an hour is also your average speed—fast enough to let you have breakfast in New York, lunch in Ohio, dinner in Iowa, and a midnight snack not far from the Colorado state line.

As your car eats up the miles in the express lane, you notice on your left a steel barrier that divides you from the broad two-way center lane reserved for express bus traffic. Built into the middle of this bus roadway at the outskirts of cities and towns, and at railroad and route junctions, are station platforms, served by moving stairways from waiting rooms below. Here passengers change from interstate busses





Drawing by  
B. G. SEIELSTAD



This is how traffic experts envisage the superhighway of tomorrow. Careful design, and an elaborate system of electrical safety devices, will enable heavy streams of vehicles to move with a minimum of danger even at high speed.

to local lines to be whisked into cities and towns adjacent to the main highway.

Still farther to the left, traffic is speeding along at a controlled pace in the duplicate one-way road section for cars traveling in the opposite direction. But as you marvel at the efficient handling, safety, and speed of this 1988 traffic, it suddenly dawns on you that this superhighway has no roadside markers, no painted warnings on the pavement, not even a signpost to direct you along the route. You search in vain for any of the familiar signs that in 1938 were almost as much a part of the highway as the paving—"Sharp Curve," "Winding Road," "Steep Hill"—these signs, and the necessity for them, have disappeared from main routes years ago.

"But how do I find my way around?" you ask your guide. "How do I know where to turn off for Middletown or Centerville? Is every motorist a mind reader these days?"

Your guide smiles and suggests that you swing off the traveled lanes and nose into one of the parking bays that line the

shoulder of the road. "Take a look at that dashboard," he advises as you pull up to a stop out of the stream of traffic.

At first glance you spot a few of the familiar dials and instruments—speedometer, fuel gauge, ammeter. After a little study you figure out a few of the others—tachometer, tire-pressure gauge, engine-temperature meter. But what is that row of colored lights, and what is that white screen just over the windshield?

"Since the old days when all cars had gear-shifts and burned gasoline for fuel," he explains, "science has stripped the welter of directional and warning signs off the highway and put the essential ones right on the dashboard of each car. At 100 miles an hour, roadside markers would be no more legible than hen tracks, anyway. The law now requires every automobile to be equipped with standard, pretuned, ultrashort-wave radio and television units. On small four-lane side roads, traffic signals are indicated by the colored lights here on the panel.

"Miles before you reach any superhighway (Continued on page 118)





## HOW POLICE CAMERAS REVEAL

# Hidden Crime Clews



Enlarged photographs of fingerprints, like the one seen above, often aid in convicting criminals. Left, motion pictures being projected in a courtroom as evidence in a case under trial



**D**USK was closing down on a midwestern city when a black roadster rolled to a stop on a deserted side street. A man wearing a slouch hat stepped out, looked up and down the street, and then slipped to the rear of a neighboring store. In one hand he carried a small box wrapped in newspapers. A moment later, he returned and drove hurriedly away.

Thirty minutes passed. Then, like a clap of thunder magnified a thousand times, a blast shook the business district. The end of the store was blown to

kindling. Windows for a block around shattered into fragments. The box had held a time bomb filled with high explosives. Fortunately, the intended victim had stepped to the front of his store and escaped without a scratch.

All night long, detectives combed the ruins looking for clews. They photographed the debris. They made casts of footprints found back of the store. They recorded the marks left by tires on the side street. Most important of all, they retrieved fragments of the box which had held the bomb. One piece contained a finger hold characteristic

of chalk boxes used in public schools. This was a valuable clew. But it was another fragment which provided the astonishing piece of evidence that solved the crime.

Under a magnifying glass, one of the detectives noticed what appeared to be faint printing on the piece of wood. He hurried to the photographic laboratory at police headquarters. Here, the expert in charge of the crime-fighting cameras slipped a filter over his lens, adjusted photoflood lamps to throw a strong side lighting on the wood, and snapped the picture.

Detectives crowded around him as he lifted the dripping negative from the developing bath. On it, faint but legible, was printing from a newspaper. The explosion had forced the wood against the paper so violently that an impres-



## By GROVER C. MUELLER

sion of the printing was left on the box fragment. It proved to be part of an item published in a paper in a neighboring city only twelve hours before the blast. This clew led directly to a known enemy of the storekeeper, a school janitor in that city. Confronted by detectives, he confessed his crime.

This amazing instance is but one of many in which photography has played a leading rôle in solving major crimes. The scientific sleuth of today is depending more and more upon the round, gleaming eye of the camera to search out hidden clews. He has gone photographic, and is using everything from huge color-movie outfits to miniature cameras, from highly magnified enlargements to candid snapshots, to trail and convict his man.

Only a few days ago, in New York City, a camera which "saw" something invisible to human eyes led to the conviction of a murderer. A week before, radio cars had raced to an outlying tavern in response to an emergency call. They found a man stabbed to death. The assailant had made his escape. When a suspect was being questioned at police headquarters, a week later, the photographer who had just "mugged" him noticed a peculiar thing about the picture. The faint outlines of a stain ap-

peared on the freshly laundered shirt the man was wearing. Questioned about it, the suspect became confused, gave conflicting statements, and finally broke down. During the struggle with the victim, his shirt had been stained with blood. It had been washed out, but the faint, remaining discoloration, unnoticed by the eye, had been recorded by the supersensitive panchromatic film in the camera.

In another instance, the same type of film revealed an overlooked bloodstain on a carpet. In examining a room where

a murder was thought to have been committed, detectives shot pictures from different angles for later reference. When they studied the developed films, they discovered the outlines of the stain. Although the carpet had been washed carefully, the discoloration was apparent to the camera.

Such films, sensitive to red as well as to other colors, are a boon to the crime fighters. Old types of film were "color-blind" to red. Recently, a new photographic emulsion, said to be four times as fast as that (Continued on page 114)

Cameras "balk" many insurance frauds. In a typical case, a man receiving compensation for an injury claimed that he could not bend his arm. The company had to pay until a camera sleuth snapped the man at work in his garden



Pictures of mobs and riots, made by press photographers or newsreel cameramen, often prove valuable to law-enforcement authorities in identifying ringleaders and participants for arrest



Aerial photographs sometimes reveal objects not visible to observers on the ground. They also are used in hunting bodies under water

From Tiny Candid Snapshots to Colored Movies, Photography Is Helping Modern Scientific Sleuths To "Get Their Men"



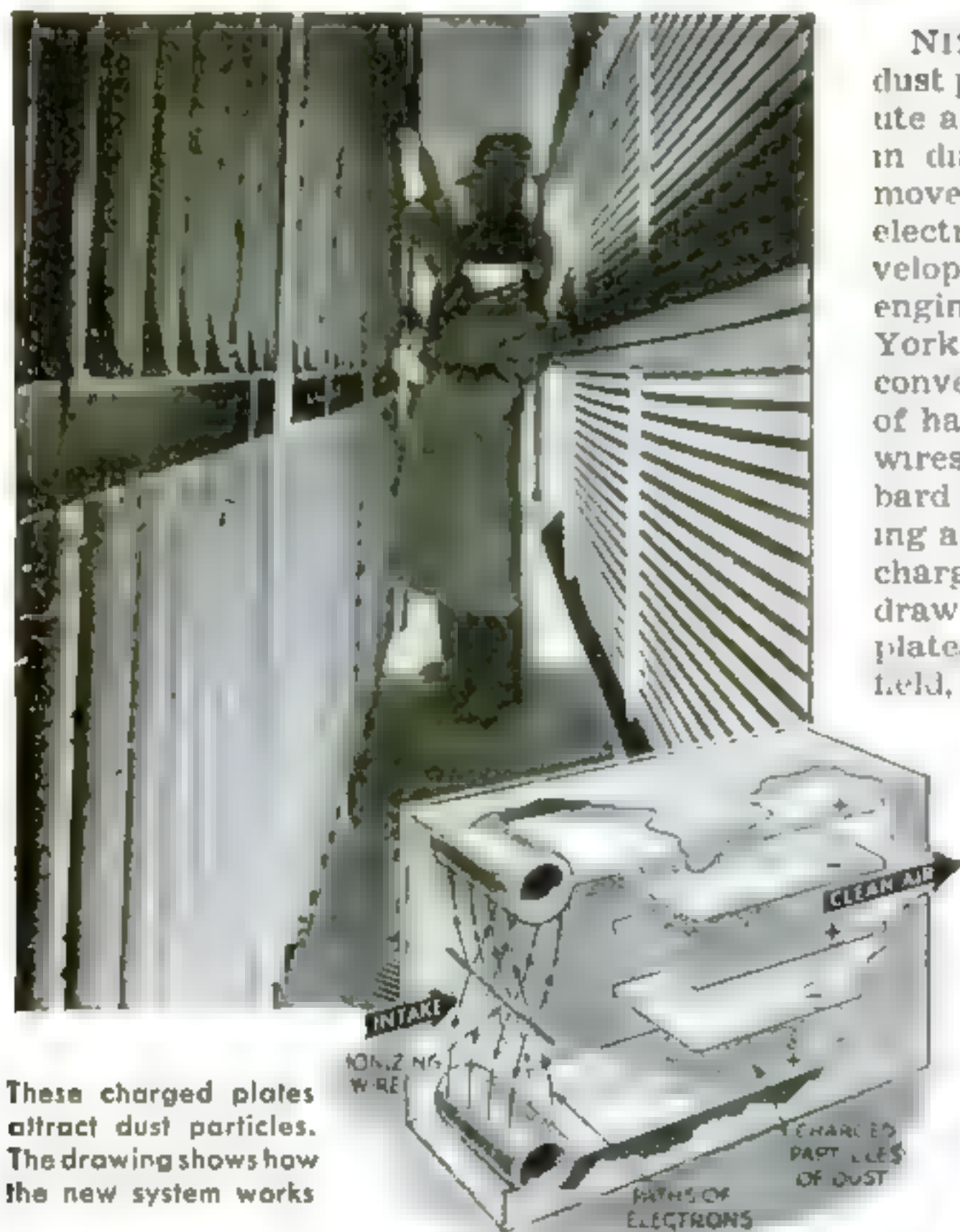
## All Comforts of Home Are Built into Bed



The make-up tray in use. Some of the other conveniences of the handy bedroom unit are seen in the view at left

CLOCK, radio, bookshelves, telephone, storage drawers, outlets for electrical appliances, and other conveniences are provided in the novel bedroom unit shown in the photograph at the left. By raising her arm, the occupant of the bed can swing down a rectangular make-up unit that is supported across her lap by tubular arms hinged to the head of the bed. When opened, this provides a mirror and separate compartments for lotions, manicure tools, and other toilet accessories

## Air Cleaner Removes Dust By Electricity



These charged plates attract dust particles. The drawing shows how the new system works

NINETY-NINE percent of all dust particles, even those as minute as four millionths of an inch in diameter, are said to be removed from the air by a new electrical cleaning apparatus developed by Westinghouse research engineers and installed in a New York City store. Replacing the conventional mesh filter, a series of hair-thin, electrically charged wires in the intake system bombard dust particles in the incoming air to give them an electrical charge. When this treated air is drawn through a system of metal plates that form an electrical field, the electrified dust particles are attracted to charged plates while the cleansed air passes on through ducts into the building, as illustrated in the typical unit shown in the drawing at the left.



## Device Labels Sausages

INDELIBLE labels are printed on sausages and other meats packed in natural casings by an automatic machine operating on the decalcomania principle. The device is designed to protect housewives from the substitution of inferior products for well-known brands.

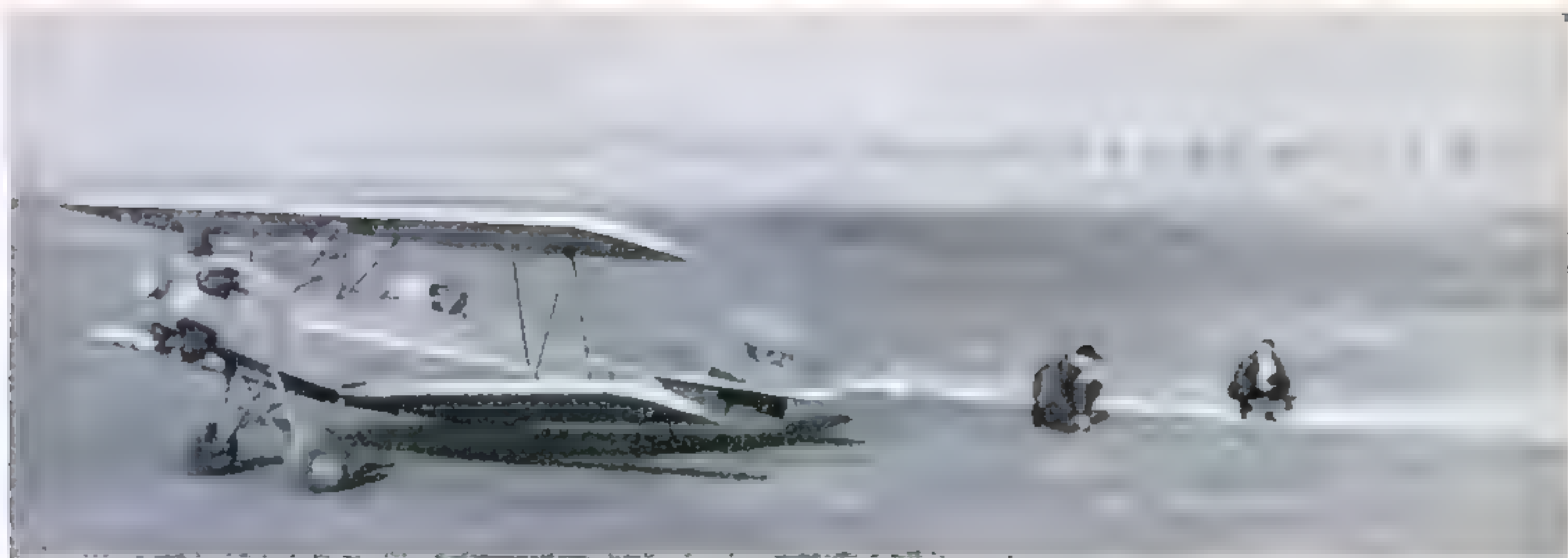
## Mechanical Batter Slugs Balls To Test Their Liveliness

TO SETTLE the question of whether the type of baseball used in one major league is more lively than that used in the other, the National Bureau of Standards devised the batting machine shown at the right. A compressed-air gun shoots a hardwood projectile, representing a bat, against the ball at speeds up to 200 feet a second. The ball is caught in a special speed-measuring device and its liveliness determined by the ratio between its measured speed and the speed of the projectile bat. In an outdoor test, the device "batted" balls many feet beyond the record of baseball sluggers.



This machine "bats" baseballs to determine scientifically how lively they are





# College Flyers

## COMPETE IN THRILLING AÉRIAL TRACK MEETS

Officials checking a pilot's showing in a spot-landing event. The object is to place the tail skid as near as possible to a line

**H**UNDRED-MILE-AN-HOUR athletes, representing the University of Southern California and Stanford University, recently met in a spectacular track meet of the air staged at Mines Field, Los Angeles, Calif. Riding in light planes, they competed in landing skill, bombing accuracy, cross-country navigation, and balloon-bursting. Each plane was allowed three minutes to accomplish the latter feat. At 2,500 feet, the pilots wheeled and zoomed in an effort to strike and explode the small gas-filled rubber balloons. Next, the ships slid down, one after the other, from an altitude of 1,000 feet while the pilots tried to land as nearly as possible on a chalk line drawn across the field. With engines roaring again, they climbed to 500 feet and hurled bombs of sand and lime at

a thirty-foot bullseye. Points were scored much as in a regular track meet. Last year, the University of Southern California won the West Coast Championship and later captured the national title in competition with thirty-four other universities.

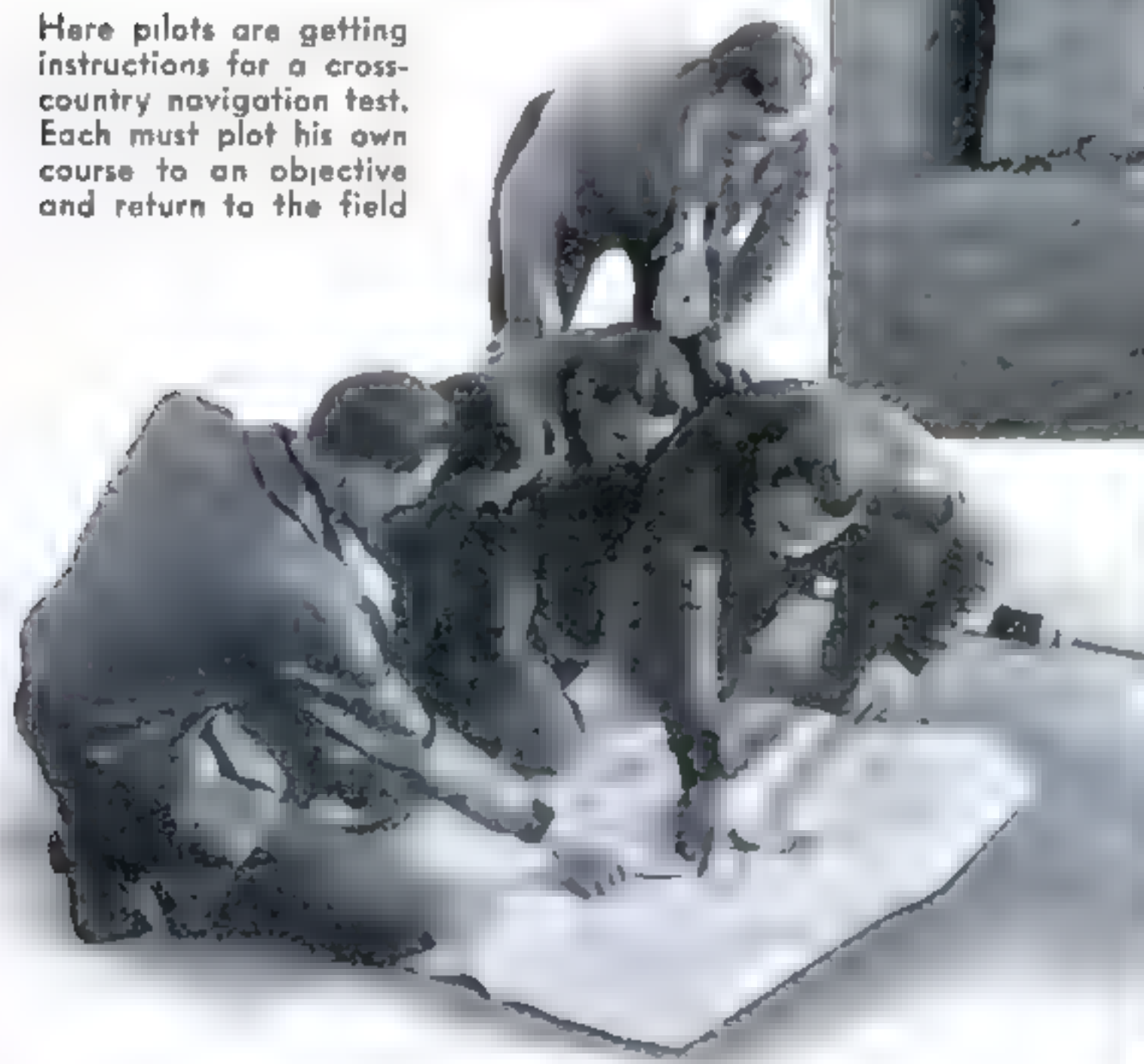


A campus ace dropping a "bomb"—a paper bag of sand and lime—on a ground target

Left, a timekeeper waves a flyer in with his checkered flag at the finish of one of the events

Scores in the bomb-dropping contest are determined by measuring hits, as shown below

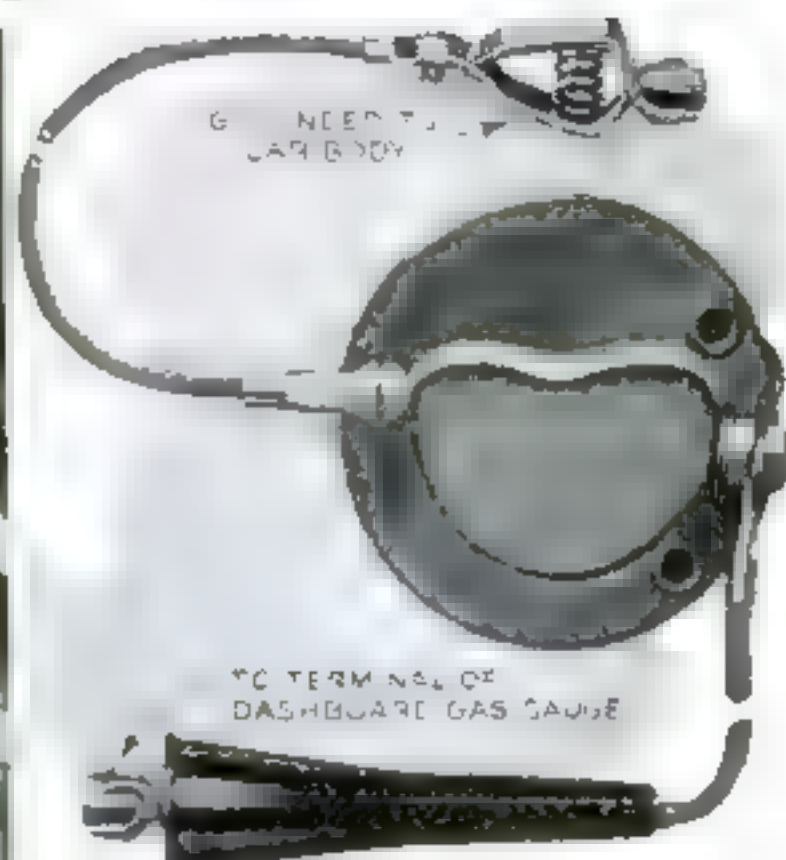
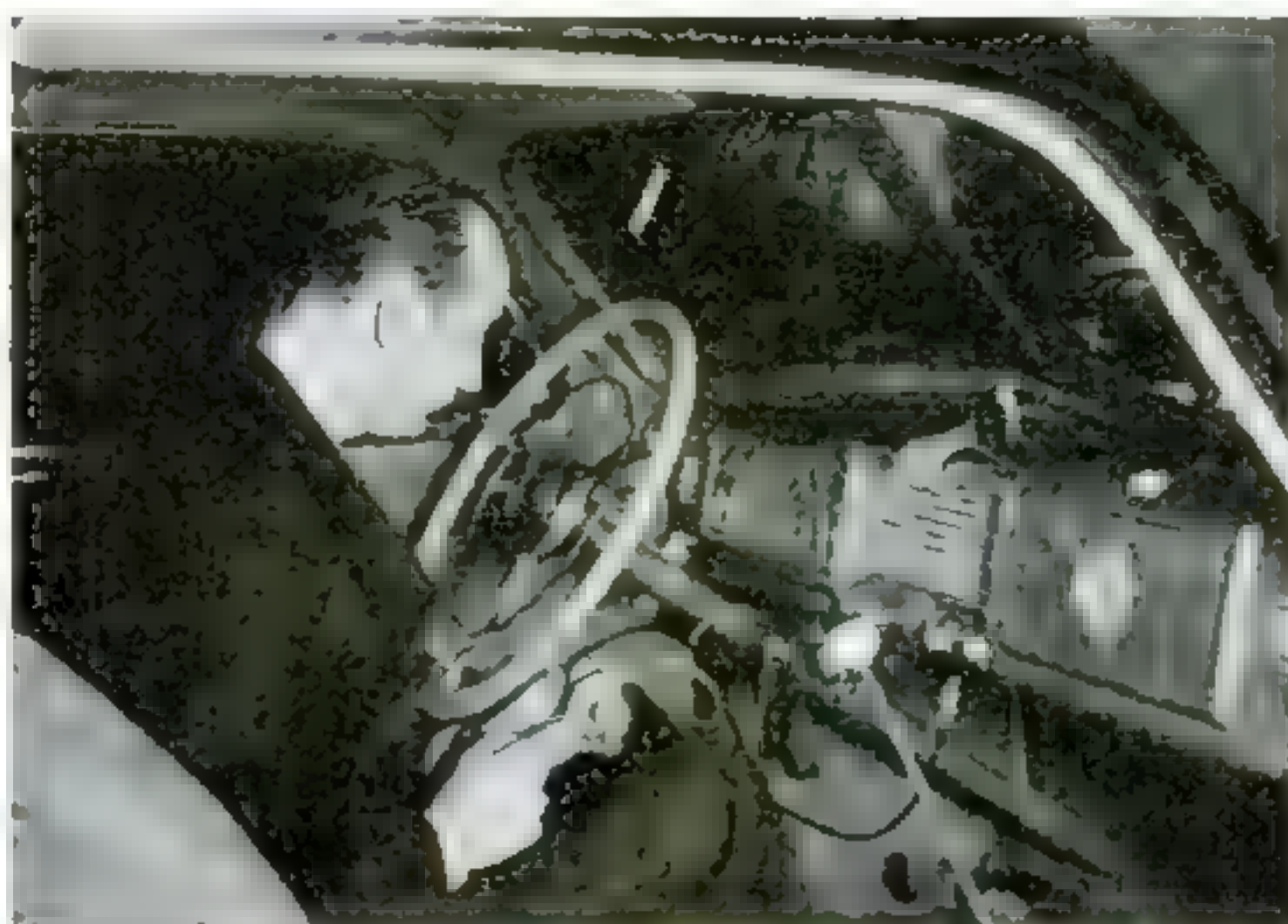
Here pilots are getting instructions for a cross-country navigation test. Each must plot his own course to an objective and return to the field





# Compact Unit Tests Electrical Fuel Gauges on Cars

**ELECTRICALLY** operated gasoline gauges on automobile dashboards can now be checked for accuracy by means of a compact testing device recently placed on the market. About the size of a watchcase, the unit is connected to a terminal of the dashboard gauge by one wire, and grounded to the car body with another. Moving a lever on the back of the test unit after the car ignition switch has been turned on, the operator is able to check the adjustment of the electrical gauge system by noting whether the needle pointer centers on the "full" and "empty" marks.



Handy fuel-gauge tester and, at left, the unit attached to a car's dashboard to check the electric gas-measuring system

## New Signal System Controls Trains in Fog

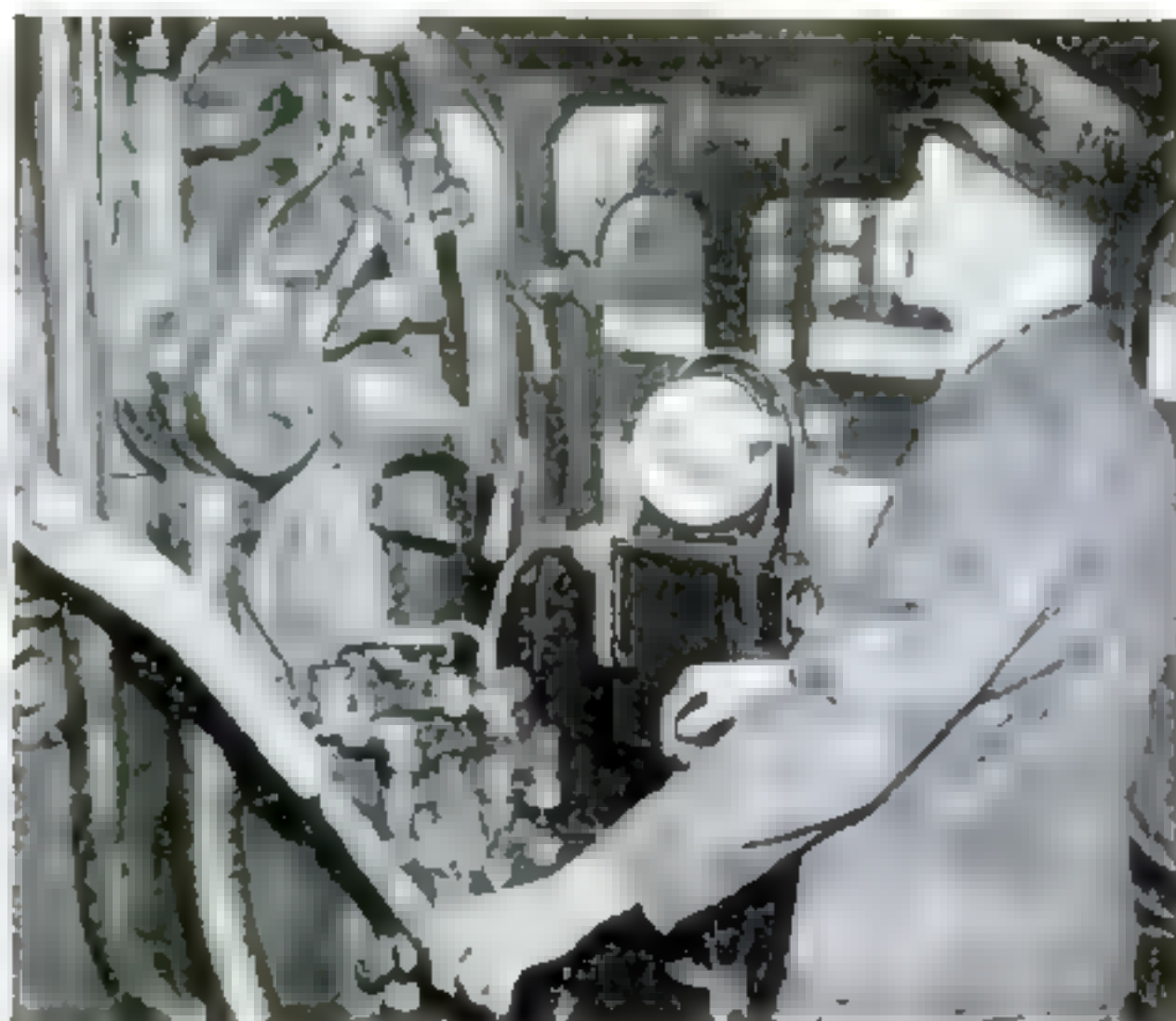
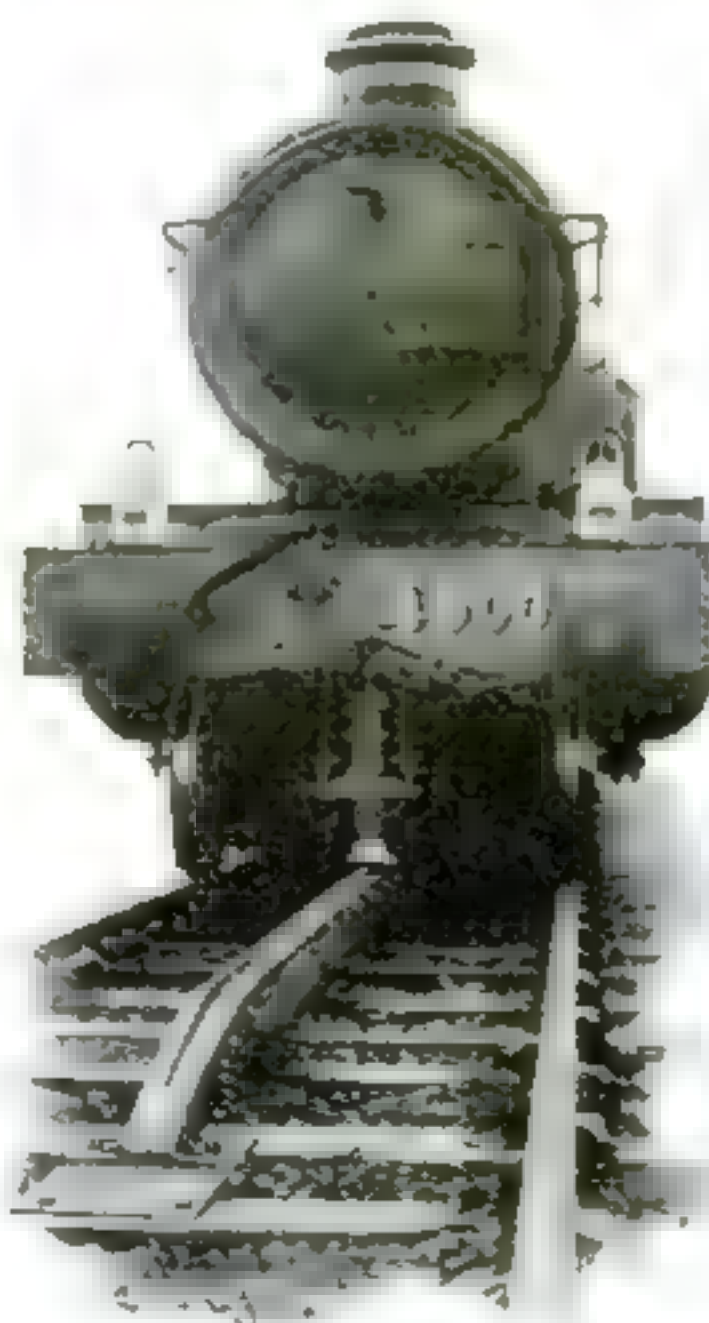
**WHEN** dense fog prevents engineers from seeing trackside signals, a new device introduced on an English railway allows trains to maintain scheduled speeds despite adverse weather conditions. As the train approaches a fog-shrouded semaphore, a metal shoe under the locomotive contacts an electrified third rail set between the two running rails. This is connected to the signal sys-

tem so that if the track ahead is clear, a bell rings in the cab, informing the engineer that it is safe to proceed at his present speed. If the signal arm is set at the "caution" or "stop" position, however, a siren blares and brakes are automatically set throughout the train to bring it safely to a stop. On account of the frequent occurrence of fog in England, visual signals are often obscured.



## Laboratory Checks Up on Shipping Cartons

**BELIEVED** to be the only one of its kind in the world, a laboratory recently set up in New York City tests the strength and durability of cartons and other cardboard containers used by manufacturers in shipping merchandise. In the photograph above, a laboratory technician is checking the "puncturability" of a cardboard carton used for shipping cans of automobile motor oil.



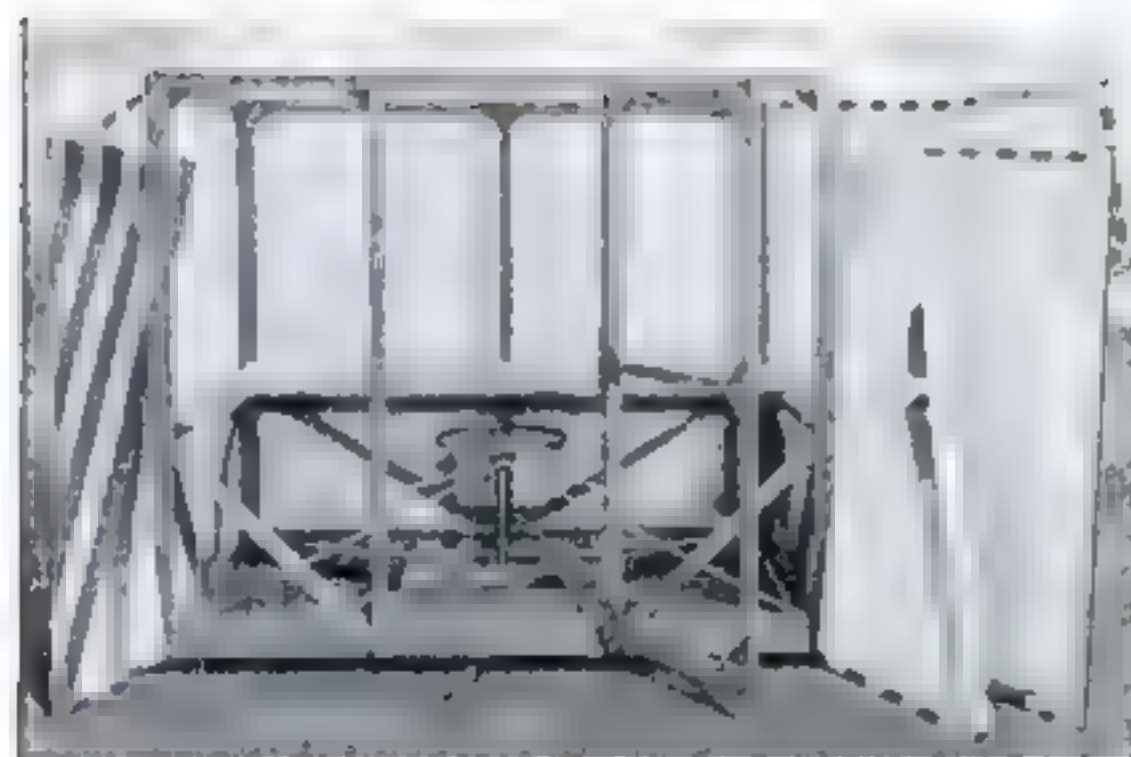
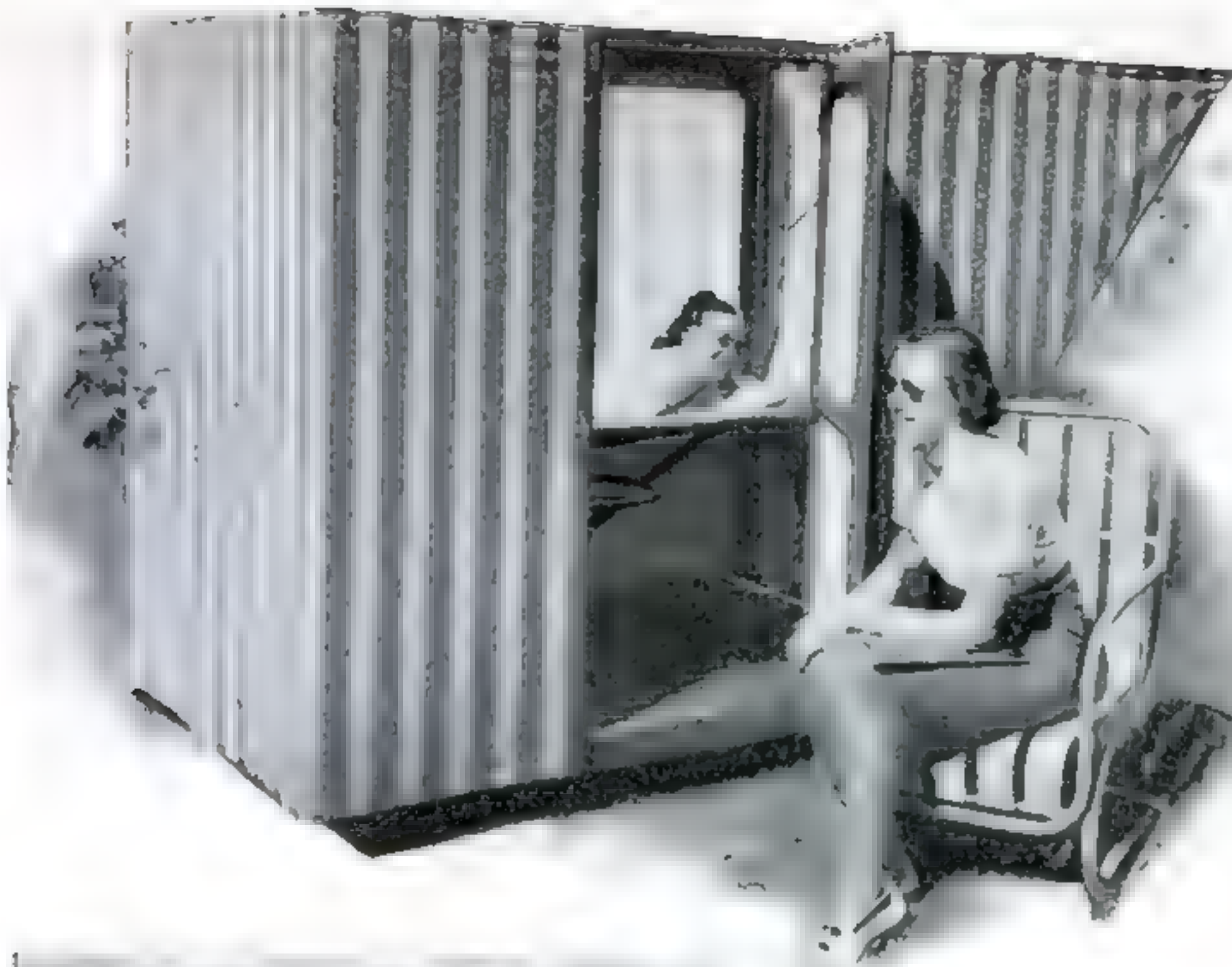
Just in front of the engineer is the signal device that tells him whether or not the track is clear as the engine passes the contact rail seen at the left

## Rubber Spokes Give Bounce to Airless Safety Tires

**HARD WOOD**, embedded in rubber, forms the rim of a new safety tire invented by J. V. Martin of Garden City, N. Y. Said to be more resilient and lighter than pneumatic types, the safety tire has hoops of hickory incased in rubber and fitted with criss-cross spokes of ribbed rubber. Punctureproof and blowout-proof, the airless tires absorbed practically all vertical movement when a springless test car drove over four-inch blocks strung along a concrete road in a recent trial, it is claimed.







Portable sun-bathing tent with front walls removed, showing rotating mechanism. Top view, shelter in use

## Rotating Shelter Aids Sun-Bathers

BY TURNING a "steering" wheel while lying on a cot within the canvas side walls of a new tent, a sun-bather can rotate the "sun tub" to follow the movement of the sun and thus insure maximum exposure to its rays. The 150-pound sun-bathing tent can be folded compactly for easy transportation.

## Dental Patients Can Give Themselves Gas

DENTAL patients administer pain-killing gas to themselves with an improved type of inhalator recently demonstrated at a display of dentists' equipment. Connected to a cylinder of nitrous oxide, the apparatus is strapped to the head and adjusted so that inhaling tubes extend into the nostrils, as shown below. By pressing a hand bulb, the patient can take just enough gas to deaden pain as the dentist works on the teeth.



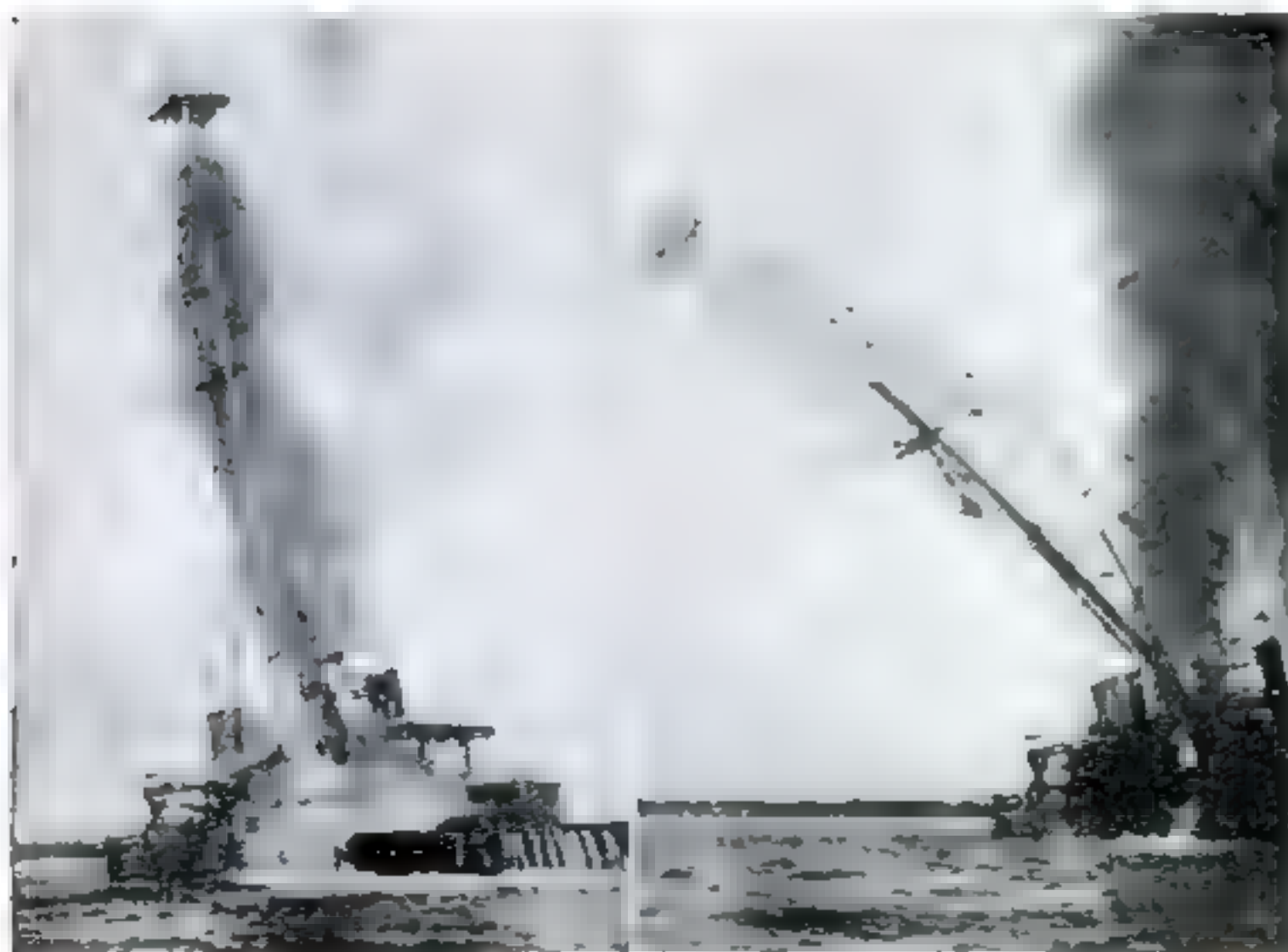
With this inhalator strapped to the face, a patient can take gas by pressing a hand bulb

## Photographs Tell Story of Odd Oil-Well Explosion

WHEN an oil well being drilled in the bed of Lake Maracaibo, Venezuela, blew out and the derrick collapsed into the water, a photographer snapped the remarkable set of pictures reproduced below by courtesy of the National Tube Company. The derrick and drilling machinery were mounted on a platform supported by piles driven into the lake

bed. When gas and oil pressure undermined the piling, the surface structure began to topple, as shown in the first photograph below. As the derrick collapsed, the 1,100-foot drill pipe was blown from the hole, became snarled temporarily in the derrick girders, and then whipped itself free and was shot out to a height of almost 800 feet in the air.

The photograph on the extreme right shows the drill pipe falling back into the water less than thirty feet from the launch which was carrying the drilling crew to safety and from which this set of pictures was being taken. Later examination of the six-inch pipe revealed not a single fault or fracture throughout its entire length.



Oil derrick in Lake Maracaibo, Venezuela, toppling as gas pressure undermines its supports. Note the drill pipe forced up into the tower



As the derrick collapses, the six-inch steel drill pipe frees itself and whips upward, shooting into the air to a height of almost 800 feet



LATEST  
BOATING  
SPORT...

# Sailing

**A**MATEUR boat builders in many parts of the world are going down to the sea in midget ships. They are putting off in men-of-war, square-rigged traders, ocean liners, and superdreadnoughts barely larger than rowboats, yet reproducing in every detail ships that are famous in nautical history.

Off the Eastern Shore of Maryland, in the summer, Capt. Carl von Zielinski, of Staten Island, N. Y., maneuvers his *Isobel III*, an eighteen-foot reproduction of an early American trading brig. It is complete even to the black disk painted on the fore-topsail, the insignia of the famous Black Ball Line of clippers and packets.

Another sailing vessel which has been reproduced in miniature is the *Constitution*, the celebrated "Old Ironsides" of the War of 1812. Capt. James A. Callan, a veteran of the U. S. Navy, constructed the pygmy fighting ship. Recently, he presented it to the U. S. Naval Academy, at Annapolis, Md., to be used as a training vessel. Midshipmen actually sail the little frigate, climbing to the yards, furling and unfurling the sails, getting a taste of navy life as it was a century and more ago. Gun ports open to reveal sixteen miniature cannons.

British tars, recently, sailed two other midget men-of-war along the English coast during naval maneuvers. One was a reproduction of Sir Francis Drake's flagship,



German schoolboys operating large models of two of their country's famous vessels—the modern cruiser "Hindenburg," seen at the left, and the five-masted training ship "Preussen"—near Potsdam



Two views of the "Isobel III," an eighteen-foot scale reproduction of a square-rigged ship, owned and sailed by Capt. Carl M. J. von Zielinski. One man can handle the tiny craft, seen head-on in the upper picture



All hands on deck! The "crew" emerging from a model



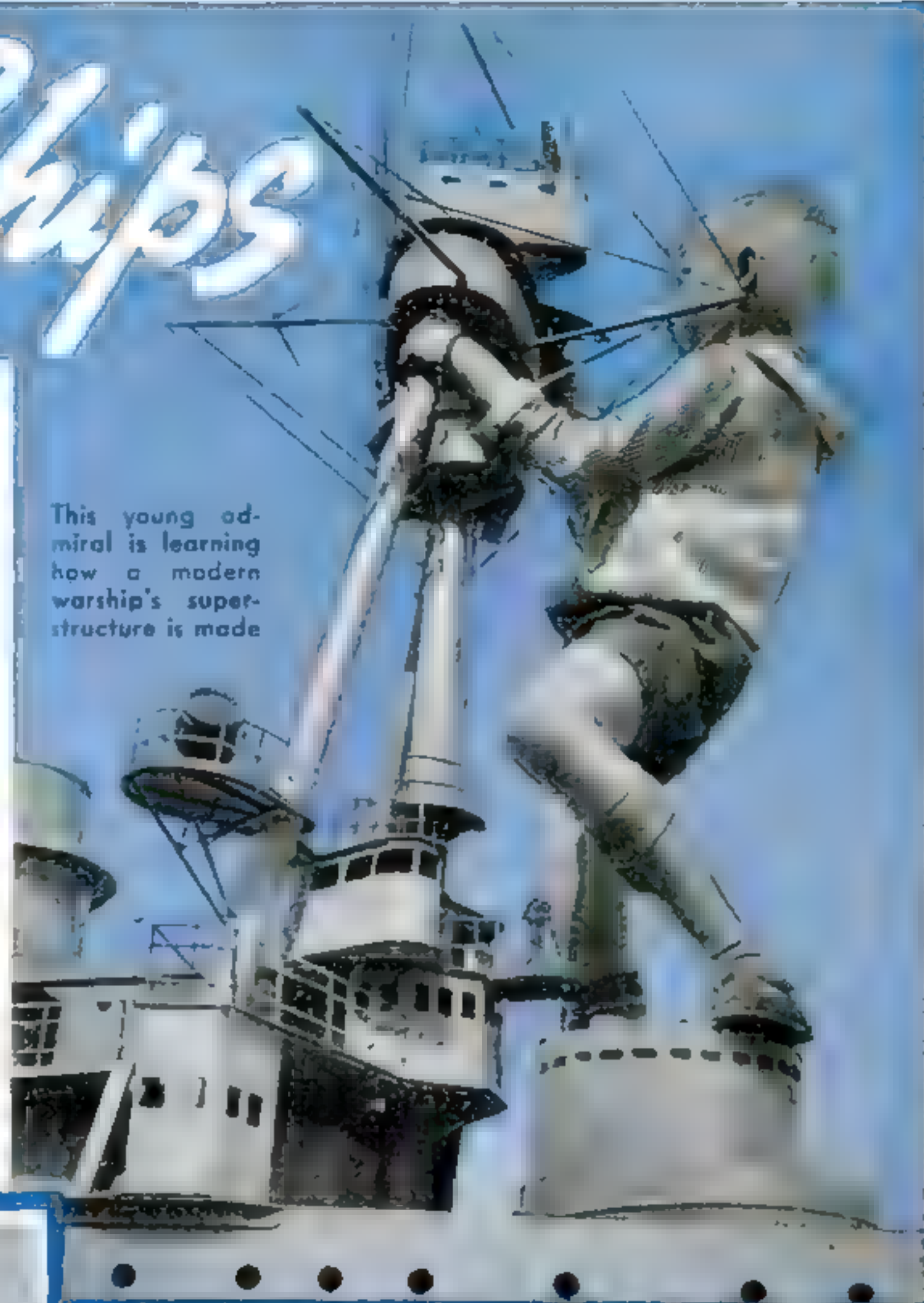
# Midget Ships

the *Golden Hind*. The other was Lord Nelson's famous fighting ship, the *Victory*. Both vessels were equipped with heavy keels and could fire broadsides from the half-size guns they carried.

In Germany, a group of sea-minded boys, at the Potsdam Boat Construction School, have reproduced in miniature two modern battle cruisers, the *Hindenburg* and the *Konigsberg*. On the decks of the former are nearly two dozen guns mounted in revolving turrets. Real searchlights flash signals from the all-steel superstructure. Both of these seaworthy models carry several sailors and make good time under their own power.

Of all the members of the fast-growing midget fleet, the most elaborate is a scale reproduction of the North German Lloyd transatlantic liner *Columbus*. This model, complete to the last porthole, attracted wide attention not long ago when it was brought to this country on the S. S. *Bremen* and given a trial run in New York Harbor. During the tests, it attained a speed of ten miles an hour.

By ARTHUR A. STUART



This young admiral is learning how a modern warship's superstructure is made



A historic vessel sails again—a half-size reproduction of Sir Francis Drake's "Golden Hind," first English ship to sail around the world. Here the model is firing a broadside from her guns



Sea scouts manning "Constitution Junior," a forty-seven-foot sailing model of "Old Ironsides." Left, a scale reproduction of the S.S. "Columbus" in the Hudson River at New York. Note the two men's heads



# New Hospital on Wheels

**BRINGS FIRST AID TO MEN WHO  
FIGHT NEW YORK'S FIRES**



New York City's new \$10,000 fire ambulance in action. An injured smoke eater being placed in the completely equipped car for surgical treatment

## ORDERS FROM THE CHIEF

Orders broadcast from the department's short-wave radio station, as at right, are received by the ambulance driver through earphones. A two-way system permits a running exchange of reports and instructions to be maintained



**F**IVE-ALARM FIRE! Thirty-five engines and trucks racing through the streets before dawn. Three hundred crack smoke eaters battling a block-square conflagration. That was the scene, a few weeks ago, when 3,000,000 feet of lumber in a big Brooklyn, N.Y., yard turned into billowing clouds of smoke and darting streamers of flame.

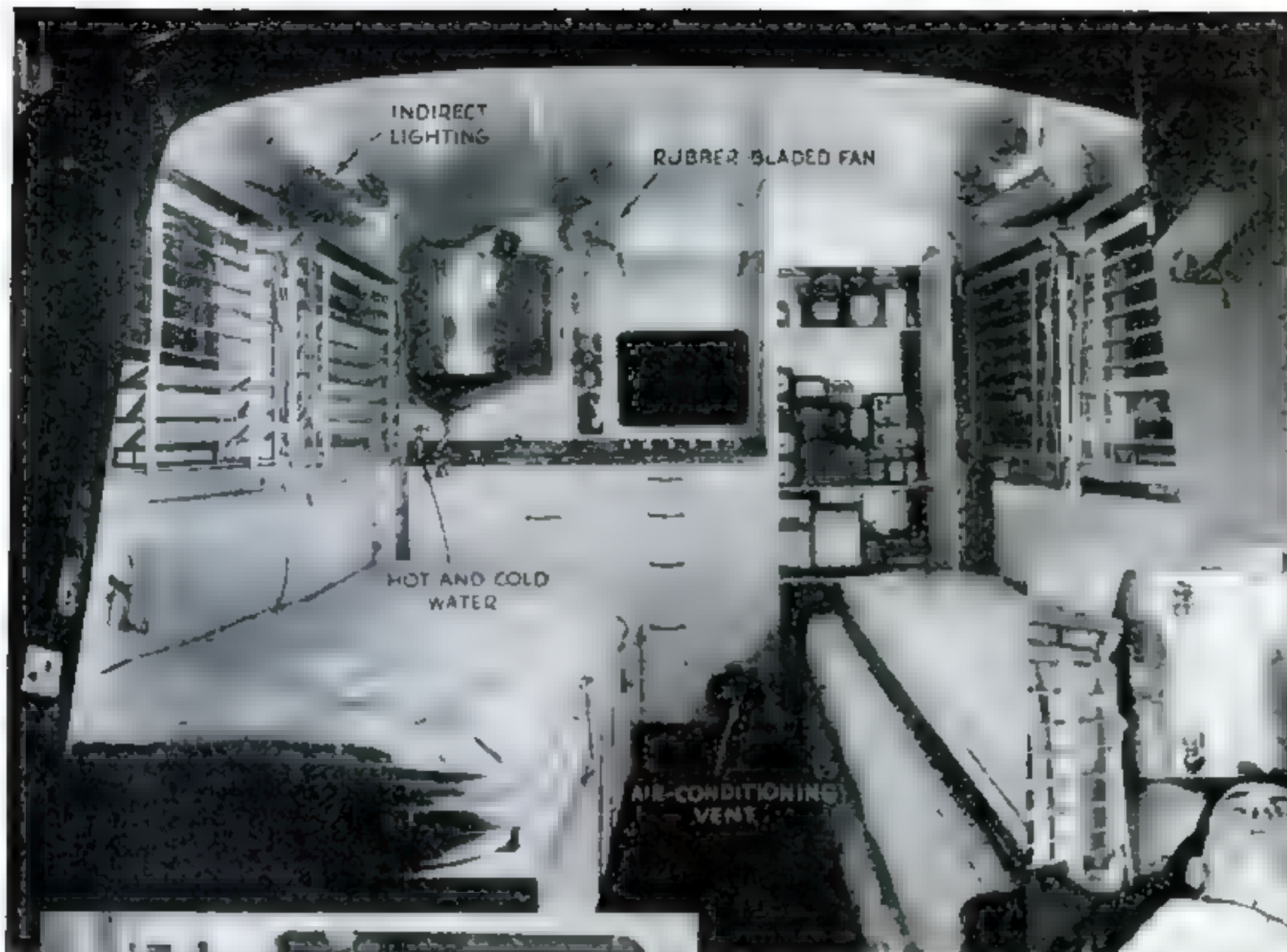
For hours, the firemen fought to keep the blaze from spreading. One man was carried out with a broken leg. Another was hurried from the scene with blood streaming from a gashed hand. Still others staggered about with eyes so inflamed they could hardly see. By the time the blaze was under control, twenty-one firemen were on the injured list. In aiding them, New York City's new \$10,000 fire ambulance—an amazingly complete, ninety-mile-an-hour hospital on wheels—played an important part. The big fire was its spectacular initiation into service.

With funds raised last year by a pageant and show at Madison Square Garden, the new machine has been equipped with virtually every aid for saving lives and treating injuries sustained by firemen. Stationed near Borough Hall, in Brooklyn, it has a roving assignment, responding to every serious fire within an area of nearly 200 square miles.

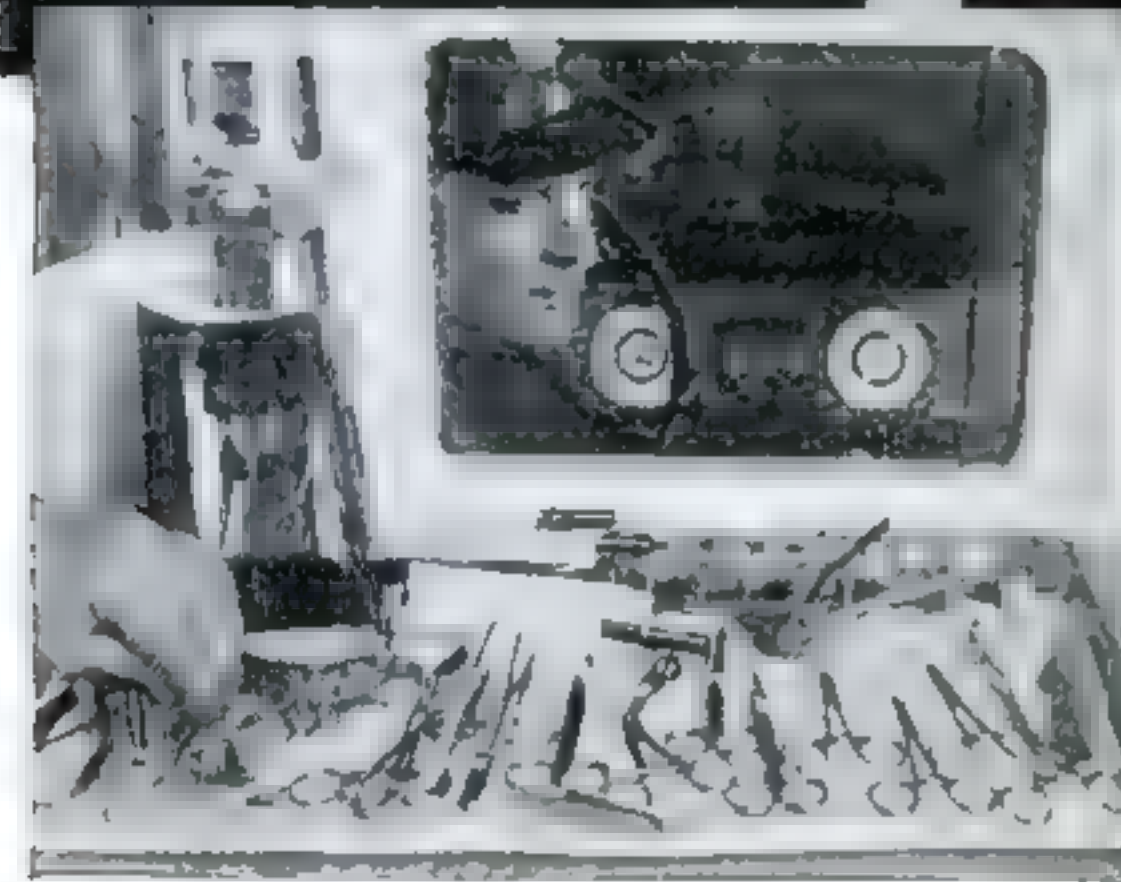
Under the red, rakish hood of the 7,260-pound machine, a twelve-cylinder engine develops 110 horsepower. In emergencies, it will carry the ambulance at speeds up to a mile and a half a minute. Above the driver's compartment, a red searchlight swings from side to side automatically while the machine is in motion, providing a warning signal that can be seen for long distances. In addition to the regular headlights, special fog lights are carried to pierce mist and rain.



By  
**JOHN E. LODGE**



At the left is an interior view of the ambulance, showing the indirect-lighting system, Venetian blinds, and storage space for surgical instruments and supplies. Below, the surgeon is using a compactly designed gauge to take the blood pressure of a patient injured in line of duty



A complete assortment of surgical instruments, seen at left, is accommodated in drawers built into the body of the ambulance



If you slip into the seat behind the wheel of the new machine, you notice that everything is designed so one man can operate the siren, the bell, and the radio, as well as run the ambulance. Your knee presses against a plunger on the dashboard. This enables you to keep the siren going while you operate the throttle with your foot. Near-by is a second plunger. A jerk on this sets the heavy bell at the nose of the car clanging. Radio orders are picked up through earphones worn by the driver, and a two-way system, similar to that used on airliners, permits a running fire of orders and reports between the mobile hospital and the department's communications center located in Central Park, where it will be safe in the event of a city-wide conflagration.

It is the interior of the ambulance, however, that presents the greatest variety of novelties and makes it unlike any other machine of its kind. The rear door closes against a rubber cushion which seals the interior and permits air-conditioning. Two vents, one for cold and the other for warm air, enable the surgeon inside to regulate the temperature to suit the needs of his patient. The warm air comes from a chamber heated by water from the engine. Venetian blinds keep out the glare of the sun in the daytime, while ten 21-candle-power lamps—four on each side and two in front—provide indirect illumination for the interior after dark.

Behind the driver's compartment is a stainless-metal sink with hot (Continued on page 120)

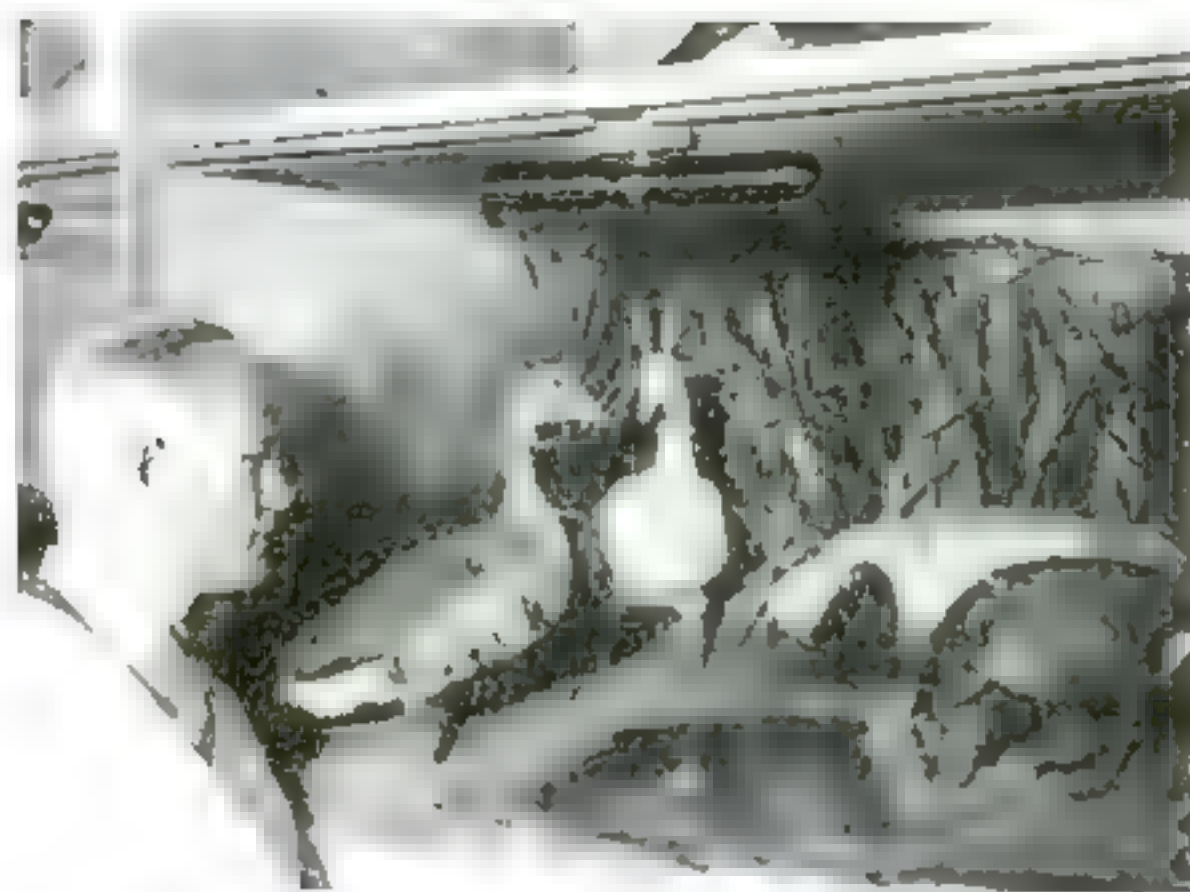


**ARTIFICIAL RESPIRATION**

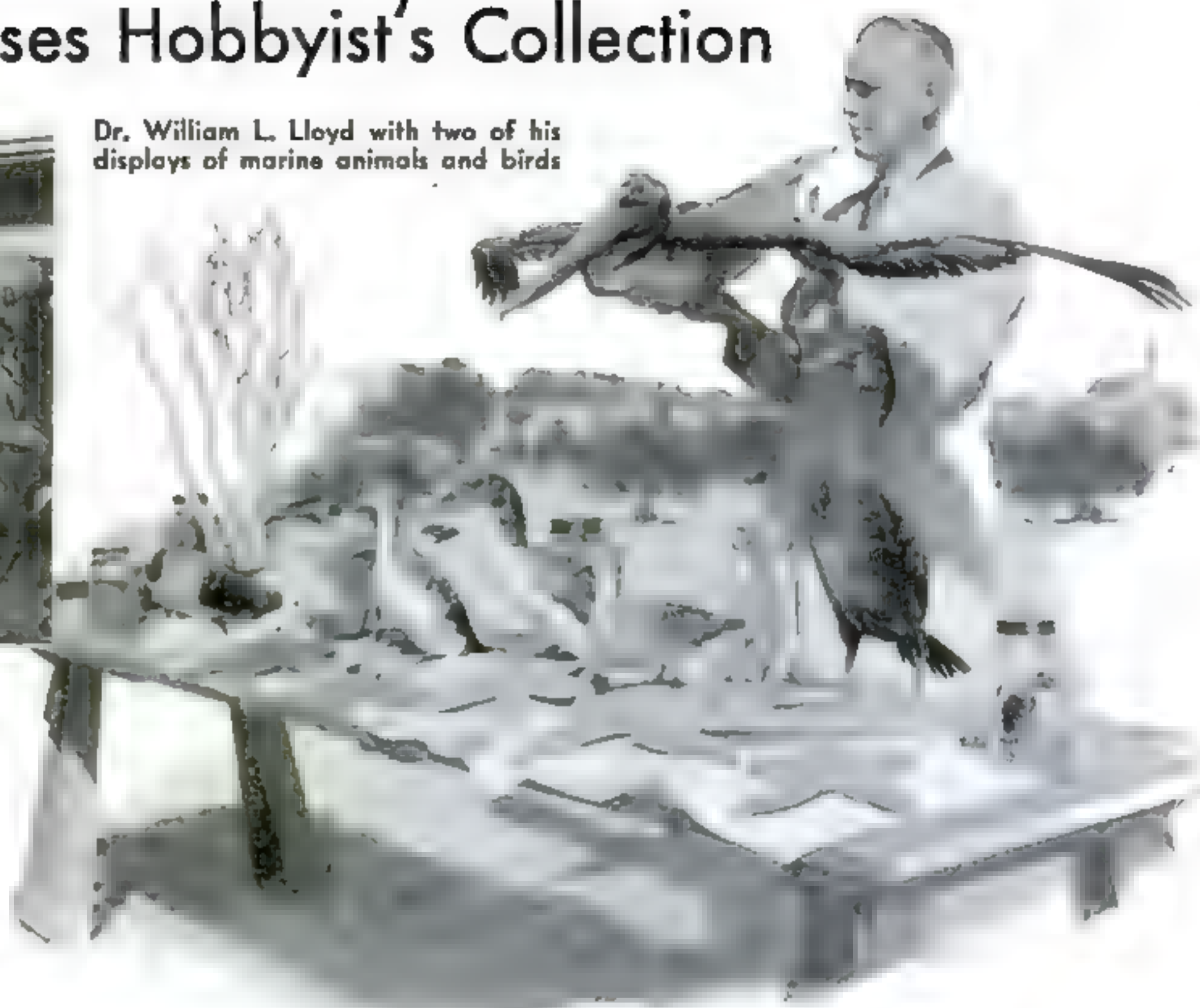
For treating large numbers of men who have been injured or overcome by the smoke in a burning building, equipment can be taken from the ambulance for use as illustrated at the left



# Beach Museum Houses Hobbyist's Collection



Dr. William L. Lloyd with two of his displays of marine animals and birds



**A** BEACH MUSEUM at Cabrillo Beach, Calif., started as a hobby by Dr. William L. Lloyd, former University of Pennsylvania biologist, aids amateur naturalists to become acquainted with native wild life. His collection of marine animals and local birds now is maintained by the Los Angeles Playground and Recreation Department in attractive exhibits.

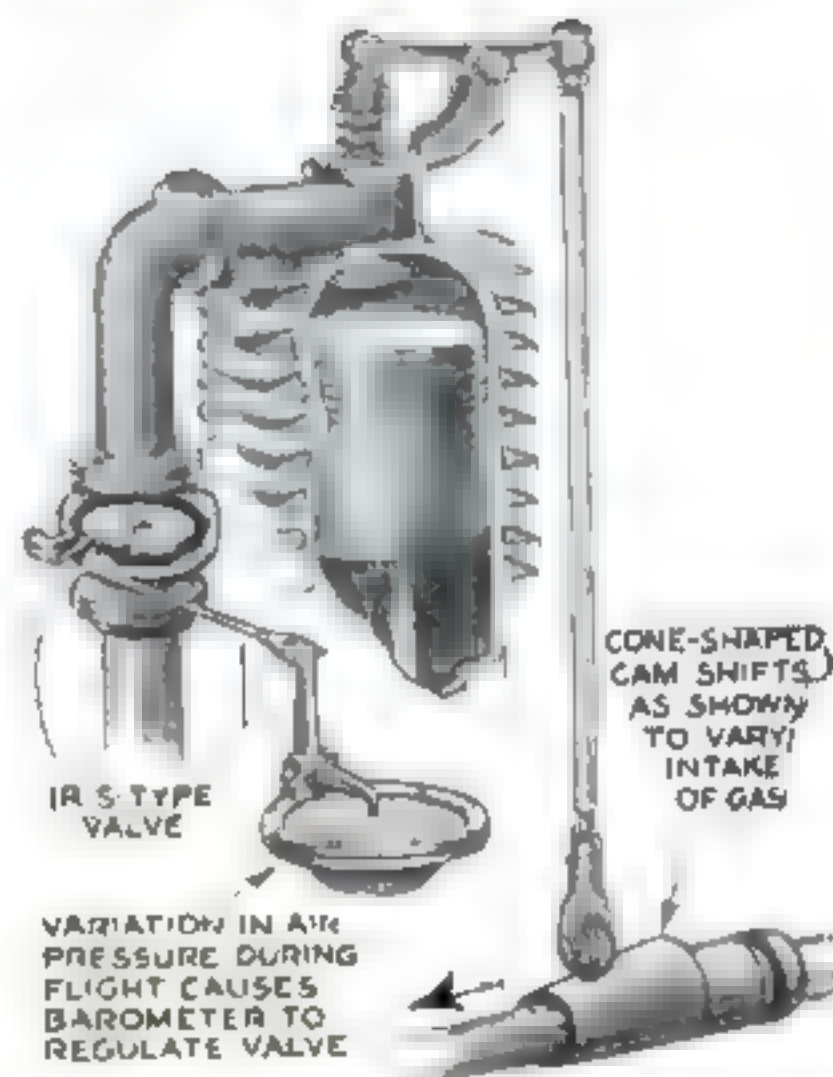


## Novel X-Ray Projector Aids Medical Students

WATCHING a surgical operation becomes doubly instructive for medical students with the use of a new portable projector, shown above, for direct projection of X-ray pictures up to eleven by fourteen inches in size. Films made while the patient is actually being operated upon are rushed to the projector and the images thrown on a screen, so that the students can follow the surgeon's movements as clearly as if each were performing the operation himself.

## Airplane Motor Adjusts Itself for Altitude

WHETHER an airplane is flying a few hundred feet above sea level or at an altitude of 20,000 feet, there will be no appreciable variation in the power of its motors if they are fitted with a new intake control, according to the inventor, A. G. Squadrani, of New York City. To compensate for changes in atmospheric pressure with altitude, a lever actuated by a barometer automatically widens or narrows the opening of an iris diaphragm that governs the flow of the fuel mixture to the cylinders. In addition, the fuel charge admitted to the cylinder may be adjusted by regulating the intake valve, which opens wider and remains open longer when a camshaft is shifted in the direction shown by an arrow in the diagram. The result, the inventor maintains, is to provide an even flow of power, a cool motor, and a reduction in fuel consumption.



## Handy New Ultra-Violet Lamp Is Portable

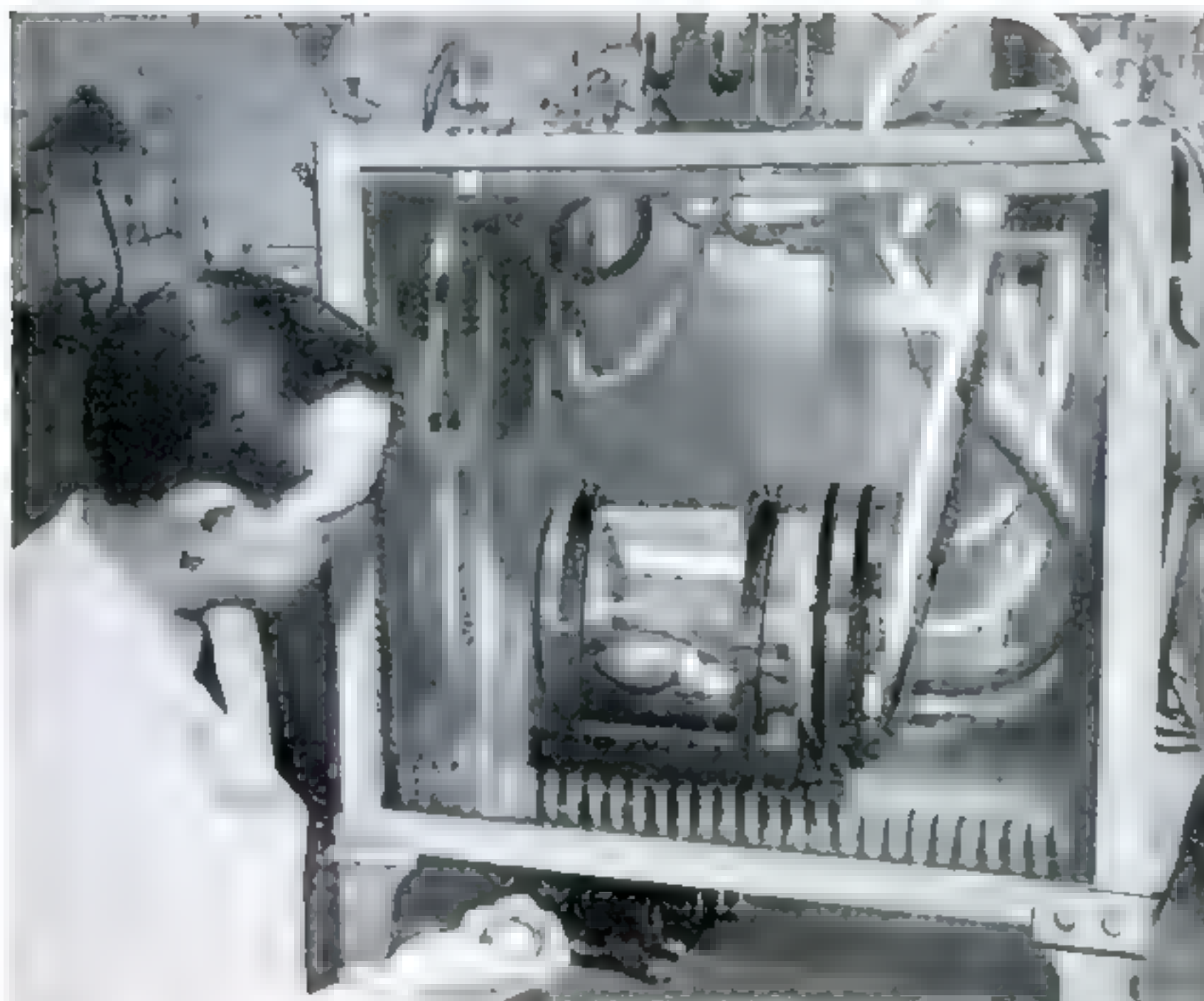


Mercury-vapor lamp in use to test effect of ultra-violet irradiation

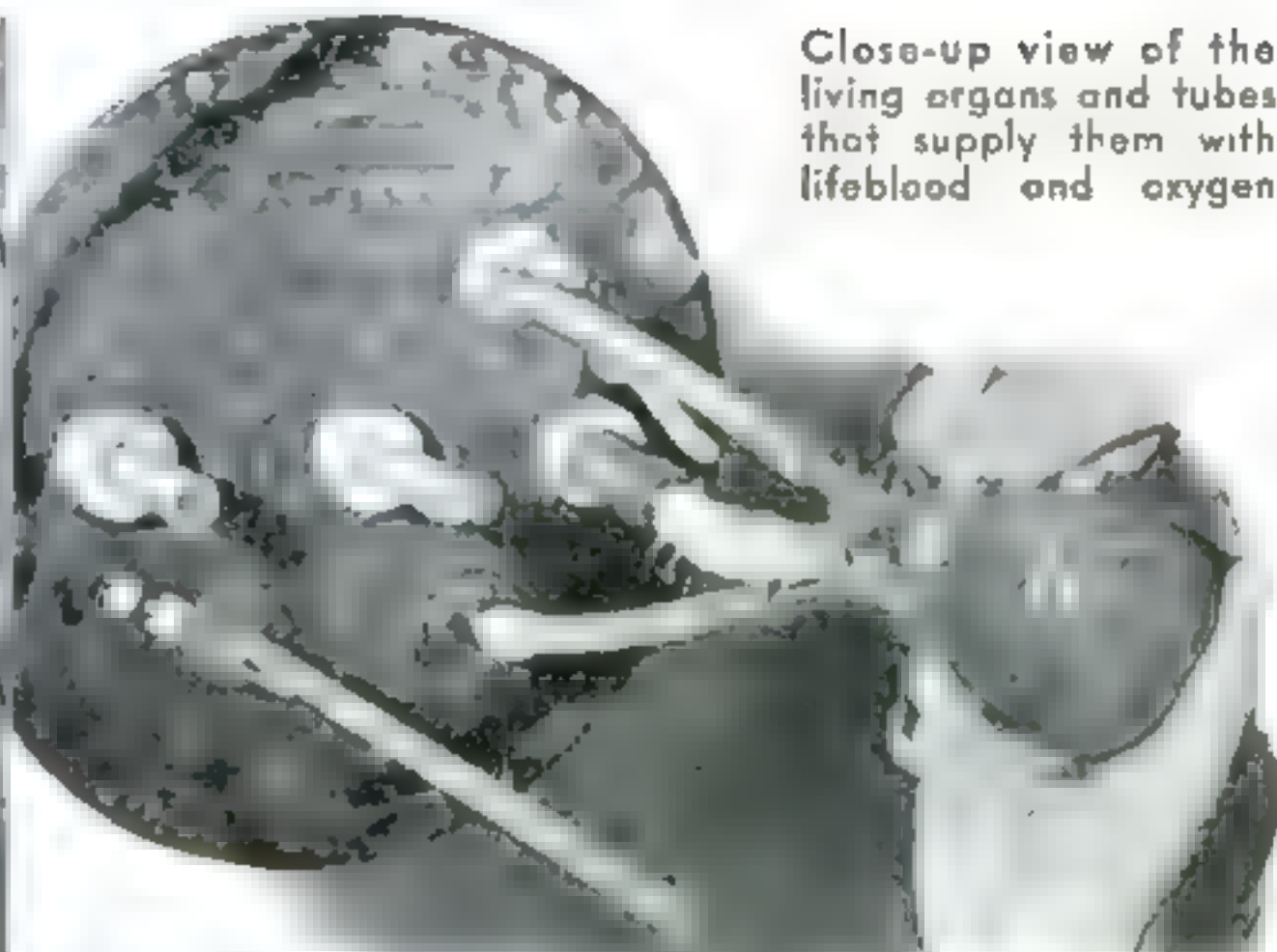
A PORTABLE mercury-vapor lamp of "self-starting" design, operating through a compact transformer, provides a handy new laboratory source of ultra-violet light. Interchangeable filters adapt it for such varied purposes as making weathering tests on industrial materials, identifying fluorescent minerals, examining old paintings, revealing crime clues, and tests on germs and plants.



# Tests Made with Living Heart in Air-Tight Chamber



An assistant watching the action of a dog's heart and lungs connected to the artificial circulatory system



Close-up view of the living organs and tubes that supply them with lifeblood and oxygen

**B**Y KEEPING the heart and lungs of a dog alive in an air-tight chamber, Dr. Maurice Visscher of the University of Minnesota recently demonstrated a startling new way to perform physiological experiments. Oxygen tubes kept the organs functioning normally while he injected drugs directly into the blood stream of the heart to study their effect. Meanwhile, delicate thermostats maintained a constant temperature within the outer water-filled tank, preventing variations that would affect the experiment or cause the "death" of the transplanted organs.



Dr. Maurice Visscher observing the reaction to drugs injected in the blood stream

## Snares of Coiled Wire Trap Tanks

COILS of ordinary wire, laid in the path of oncoming war tanks, are said to have proved their effectiveness as a barrier in recent British military maneuvers. The strands become enmeshed in the cleats of the tanks' endless treads, disabling the vehicles and rendering them an easy prey. Up-ended steel rails, planted in the ground, have also proved an effective barrier, while new antitank guns firing armor-piercing shells add to the wartime woes of the tank corps.



Tanks go all haywire when they hit this easily constructed barrier

Phil Spitalny, orchestra conductor, playing his novel candy-box piano



## Piano Case Is Transparent Cellulose

A PIANO encased in transparent cellulose instead of in wood has been constructed for Phil Spitalny, noted orchestra conductor. The innovation exposes the innermost workings of the instrument, whose tonal qualities are declared to equal those of a piano of conventional design.



# Acrobat Leaps to Glider Trapeze from Speeding Car

**L**EAPING from a speeding automobile to a trapeze bar suspended from a towed glider, a California daredevil recently performed a series of acrobatic stunts while the craft soared over the bed of Muroc Dry Lake. Drawn by a second car, the glider was maneuvered until the suspended trapeze was within reach of the acrobat's automobile. Leaving the car driverless, the daredevil snatched the hanging bar and swung up into the air.

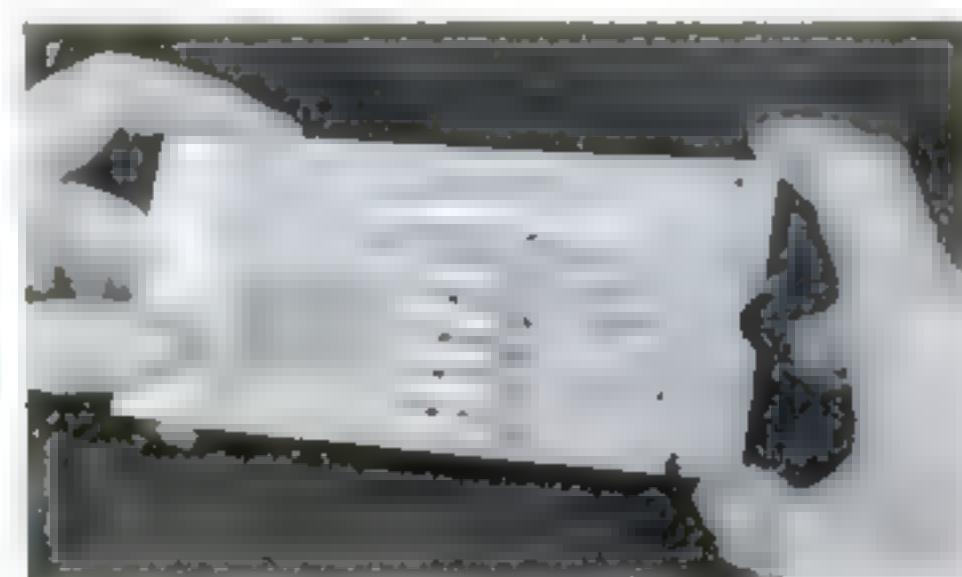
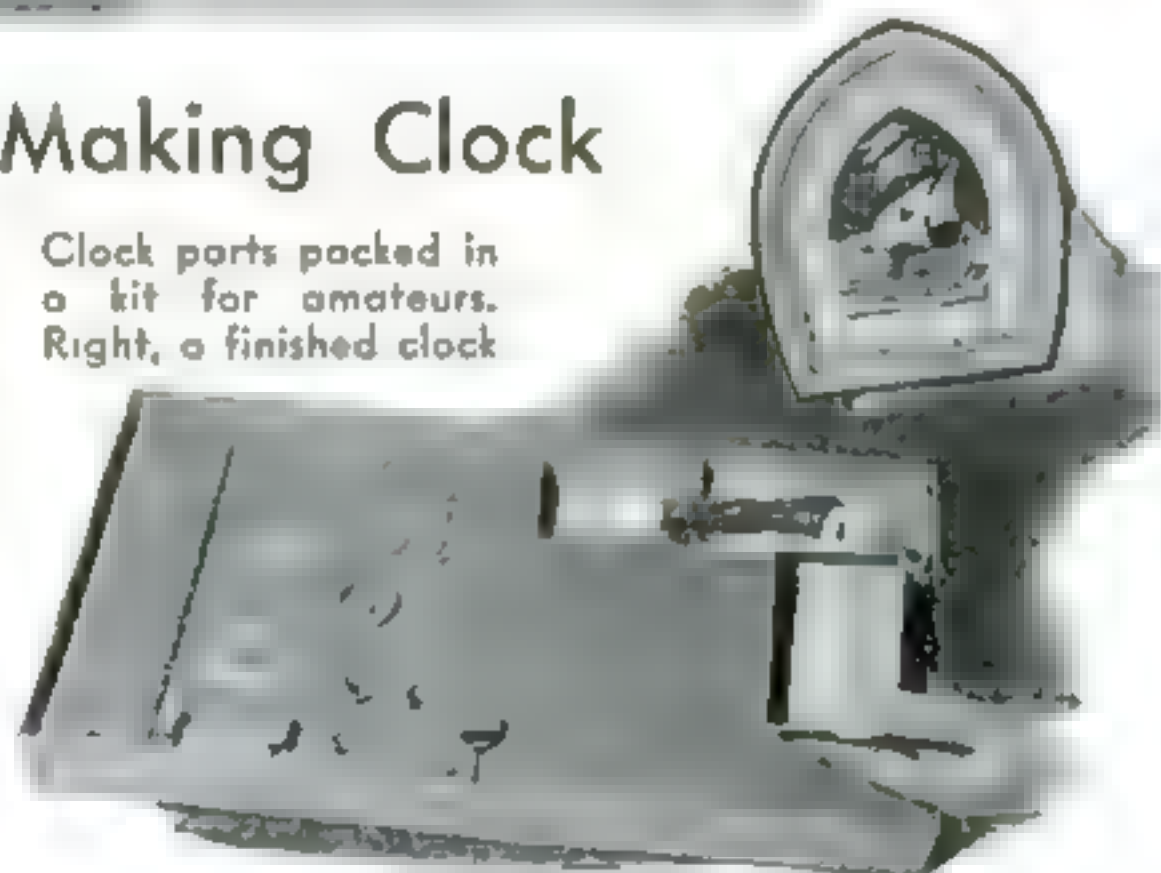


Watching for his chance, the acrobat in the speeding car grasps the trapeze bar and swings aloft under the glider

## Kit Has Parts for Making Clock

**N**EATLY arranged in a compact cardboard box, all the parts needed to make a decorative clock are included in a kit just made available. Gears and wheels are clearly marked to enable the novice to follow the instruction sheet in constructing an accurate timepiece. In the model illustrated in the photograph at the right, the one-piece dial is decorated with a painted ship.

Clock parts packed in a kit for amateurs. Right, a finished clock



## New Pocket Calculator Shows Lighting Costs

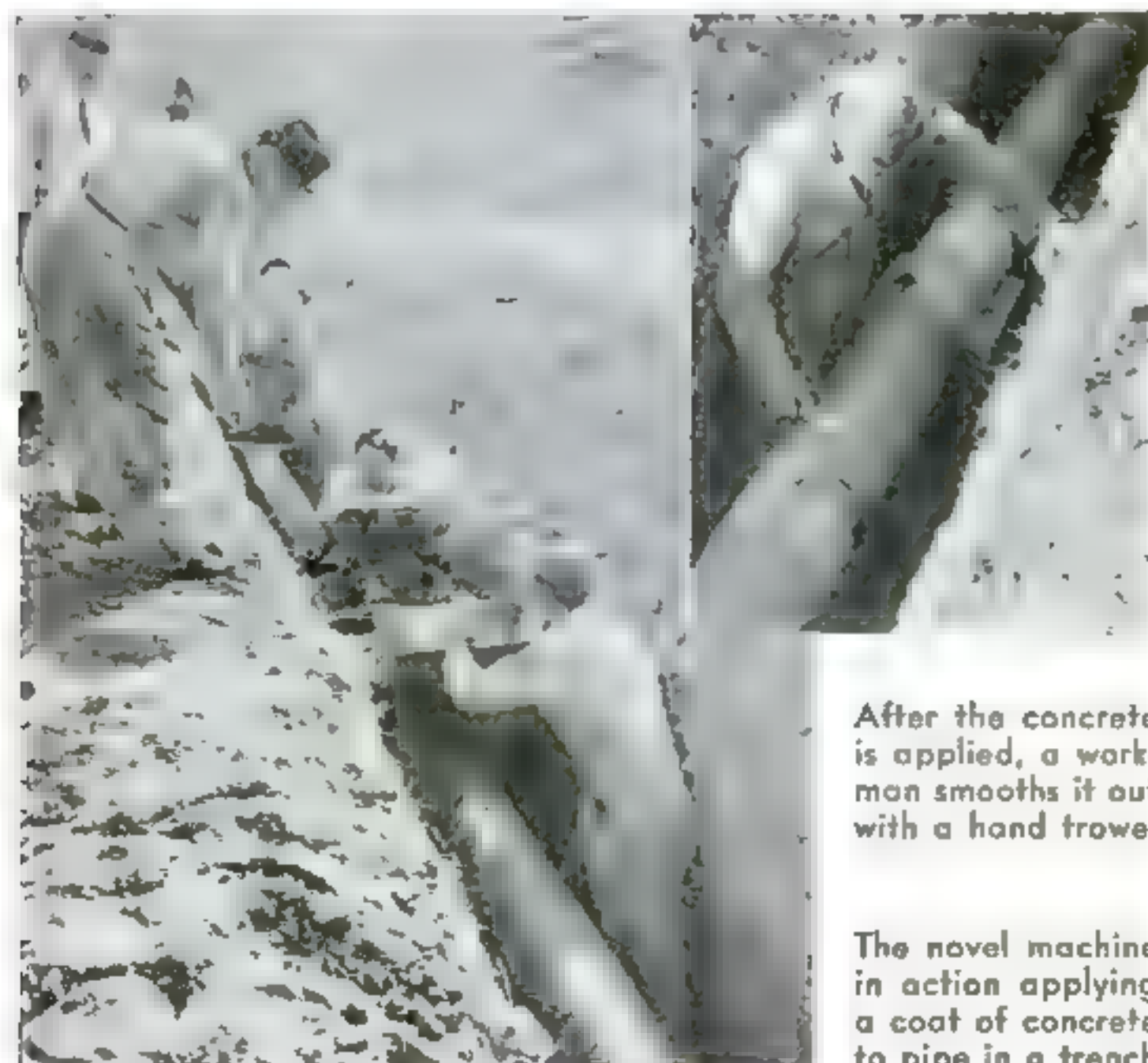
**S**MALLER than a postal card, an ingenious calculator is designed to aid lighting salesmen and buyers of large quantities of electric lamps in determining the relative cost of light, the energy wasted by inferior lamps of various wattages, and other pertinent data. Built on the principle of the common slide rule, the calculator has several sets of stationary and sliding scales which, correctly adjusted, furnish precise percentages and costs to show the economy of high-quality lamps.

## Card Keeps Golf Score

**P**ERMANENTLY recording golf scores, a novel device has a hinged cover provided with conical hole punchers on its inner surface. Pressure on one of the numbers printed on the cover punctures the same number on a score card.



## Machine Applies Concrete to Pipe in Trench



After the concrete is applied, a workman smooths it out with a hand trowel

The novel machine in action applying a coat of concrete to pipe in a trench

**P**ROTECTIVE layers of concrete or plastic material are spun onto cast iron or steel pipe set in trenches, by means of a pipe-coating machine invented by Thomas H. Wilson, of Los Angeles, Calif. Powered by a small gasoline engine that drives a steel drum surrounding the pipe, the machine smears on the coating material under pressure. As concrete is applied, the device automatically moves along the pipe. Concrete coatings are sprayed with asphalt to prevent rapid setting.





## Air-Line Hostesses Learn Low-Down on Make-up

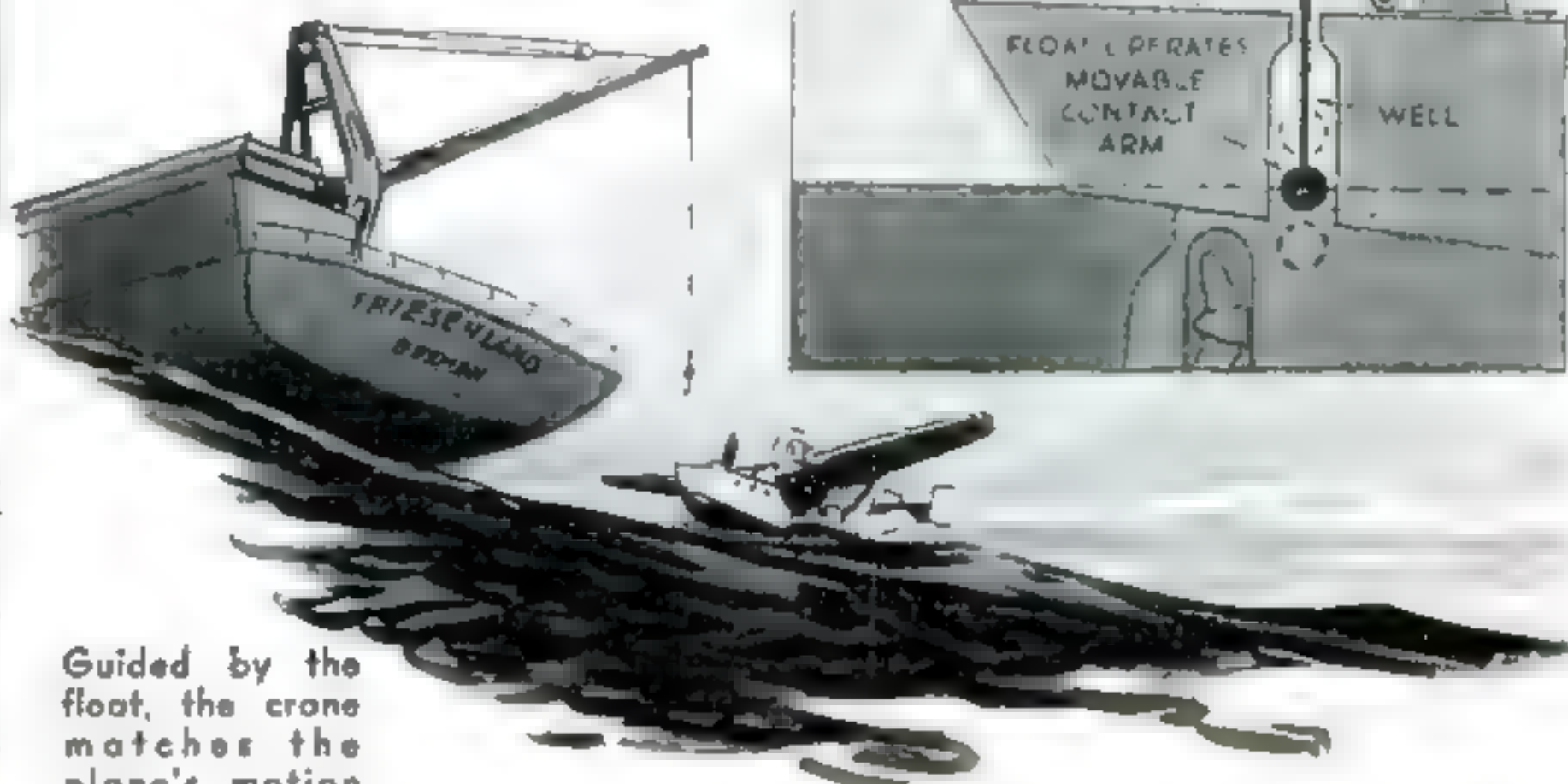
FLYING is not all a matter of machinery and weather reports, as would-be hostesses for transcontinental airliners learn in their specialized training schools. Even lessons in "flight make-up" are a part of their varied curriculum, and one of them is shown above getting instructions from an expert on how to apply a few deft touches to obtain a well-groomed effect.

## Self-Leveling Crane Lifts Seaplanes

AUTOMATICALLY leveling itself, an ingenious crane has been designed to pick up seaplanes alighting beside the steamship *Friesenland*, one of the floating airports that Germany has stationed in mid-ocean to serve as a half-way stop for transatlantic planes. To compensate for any rolling or pitching of the mother ship, movements of a float suspended in a well operate the controls of a quick-acting reversible electric motor that raises or lowers the jib of

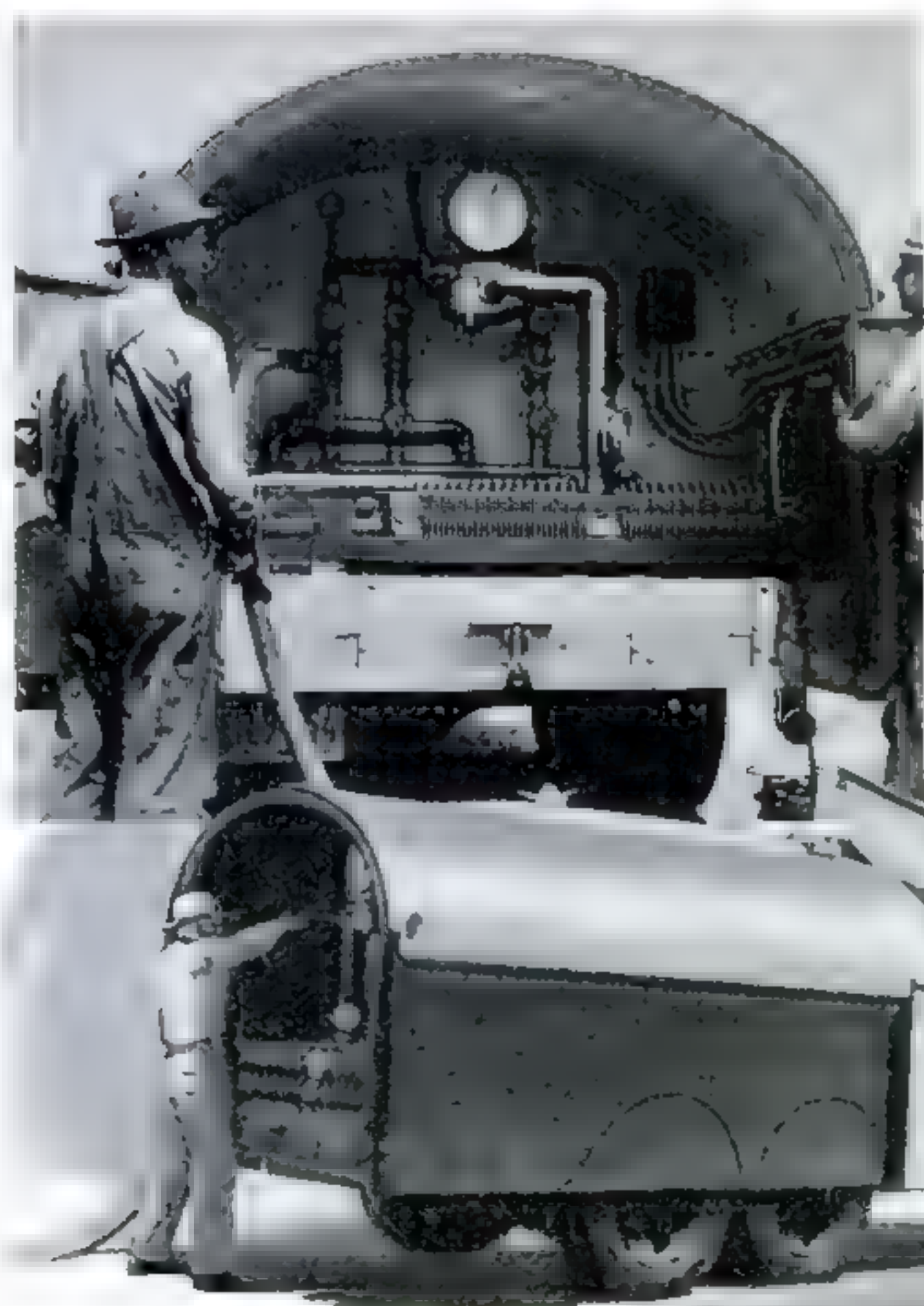
the crane accordingly. Thus the crew of the plane can secure it to the dangling hook without danger of being pitched into the water or of having their craft damaged by a sudden lurch of the *Friesenland*. Details of the novel self-leveling crane are pictured in the photographs reproduced below.

Floating on the waves, the ball controls the crane arm, as at right



Guided by the float, the crane matches the plane's motion

## Pump Truck Cleans Oil In Transformers



CLEANING the oil that serves as an insulating and cooling medium in huge electrical transformers is made a speedy and simple process by a service truck in use at Los Angeles, Calif. Electric pumps on the truck suck the oil from the apparatus and force it through a large disk of filter paper at the rate of sixty gallons a minute, returning it freed of impurities.

Transformers located in outlying districts can be quickly serviced by this truck



## Four-In-One Foot Warmer Fits Under Card Table

BRIDGE players may concentrate upon their bidding, undisturbed by chilly drafts along the floor, when a new electric warming mat is plugged into any convenient outlet. Designed to fit beneath a card table with one leg of the table on each corner to hold it in place, as illustrated above, the appliance provides four individual heating pads enclosed in pockets for the players' feet.



By EDWIN TEALE



"Everyday is circus day at Keller's," they say in the twenty-foot steel arena at his "Jungle Farm." On

Prof. George J. Keller, of State Teachers' College, Bloomsburg, Pa., with one of the two Canadian lynxes included in his private collection of wild animals

# Wild Animals

## ...COLLEGE PROFESSOR RUNS A

**O**NE of the most amazing back yards in America lies in the outskirts of Bloomsburg, Pa. Lions and leopards, bears and wolves, lynxes and cougars, inhabit it. There, when classes at State Teachers' College are over for the day, Prof. George J. Keller, instructor in art, spends his spare time training ferocious beasts as a hobby. Many graduates of his back-yard menagerie appear in vaude-

ville, circuses, and motion pictures.

A few weeks ago, when I drove over to see him, I found him unpacking a crate which had just come from Oregon. It contained a grumbling black-bear cub which Keller named Grumpy. Distributed around the yard were six-

teen sheds and cages. They held Rajah, an African lion; Satan, an Indian leopard; Lucifer and Lucy, a pair of Canadian lynxes; Adam and Eve, two Rhesus monkeys; Bobby, an albino raccoon; Tao and Tina, mountain lions from Nicauragua, as well as eagles and hawks, husky dogs, and even a badger that flattened itself and snarled continually when anyone approached.

Altogether, Keller has more than \$1,500 worth of rare birds and animals in his private zoo. He usually buys new ones in the spring, trains them during the summer, and sells them in the fall. He works twice a day, during the summer months, in his twenty-foot steel arena, once at about eight o'clock in the morning and again at seven in the evening. On Sundays, there are often as many as 150 automobiles parked along the road near his home, and last summer, when he established a "Jungle Farm" on one of the main highways leading out of Bloomsburg, 17,000 people visited it to watch him in action.

The greatest excitement occurs during the "mixed acts." Right now, Keller is working on a spectacular display in which an African lion, three mountain lions, a bear, and a leopard will perform in the same ring together. They will ride on rolling balls, jump through blazing hoops, balance on ped-



Here is Keller with Nina, his five-year-old golden eagle from Colorado. Though he had never tried to train a bird before, in nine months he taught Nina to hunt like a falcon





Bloomsburg. Here the amateur trainer is giving Rajah, his African lion, a workout summer Sundays, there are often as many as 150 automobiles parked near his home

A favorite inmate of the home zoo is Grumpy, the black-bear cub seen below at lunch. Grumpy's fame has spread far beyond Bloomsburg since his petulant growl was broadcast on a nationally known radio program



# Are His Hobby

## CIRCUS IN HIS BACKYARD

estals, and ride on a giant seesaw. Working up such an act requires months of intensive training and is divided into four stages.

The initial step is to get acquainted with each of the animals. Every beast has its own individual characteristics. Keller alone feeds them. For weeks, he studies them and plans the best angle of approach. As a general rule, the members of the cat family, including the lions and tigers, respond only to fear. Dog performers, on the other hand, will act to please their master. Keller rates the different animals thus: Cats are the biggest bluffers; dogs are the most intelligent; bears are the most erratic and unpredictable.

Once, when Keller was in the arena with two young bears, he dropped his whip. As he leaned down to pick it up, one of the animals, without the least evidence of anger, reached over and whacked him on the head so hard that he saw stars. It seemed to be its idea of having fun.

The closest call that Keller has had in ten years of amateur animal training came one evening when he was putting a trio of bears through their paces. He had been rehearsing them for a "Goldilocks and the Three Bears" act. Gruff, a 150-pound male, was taking the part of the middle-sized bear.

As it climbed down from its pedestal at the end of the act, it suddenly whirled and charged across the arena toward Keller, squealing with rage and clawing the air with its great forepaws.

Quickly twisting his whip butt-uppermost, Keller swung between the flailing forepaws and struck the animal on its most sensitive point, the end of its nose. This stopped it momentarily. The trainer followed up the attack with other quick taps on the nose. The bear changed its mind, turned, and climbed back on its pedestal.

It is rarely that a trainer strikes an animal with his whip. The lash is used mainly for cracking as a signal. The revolver which Keller always carries into the arena, is loaded only with blank cartridges. It is fired in an emergency, not to hurt the animal but to confuse it for the time being and make it forget what it had started to do. *(Continued on page 124)*

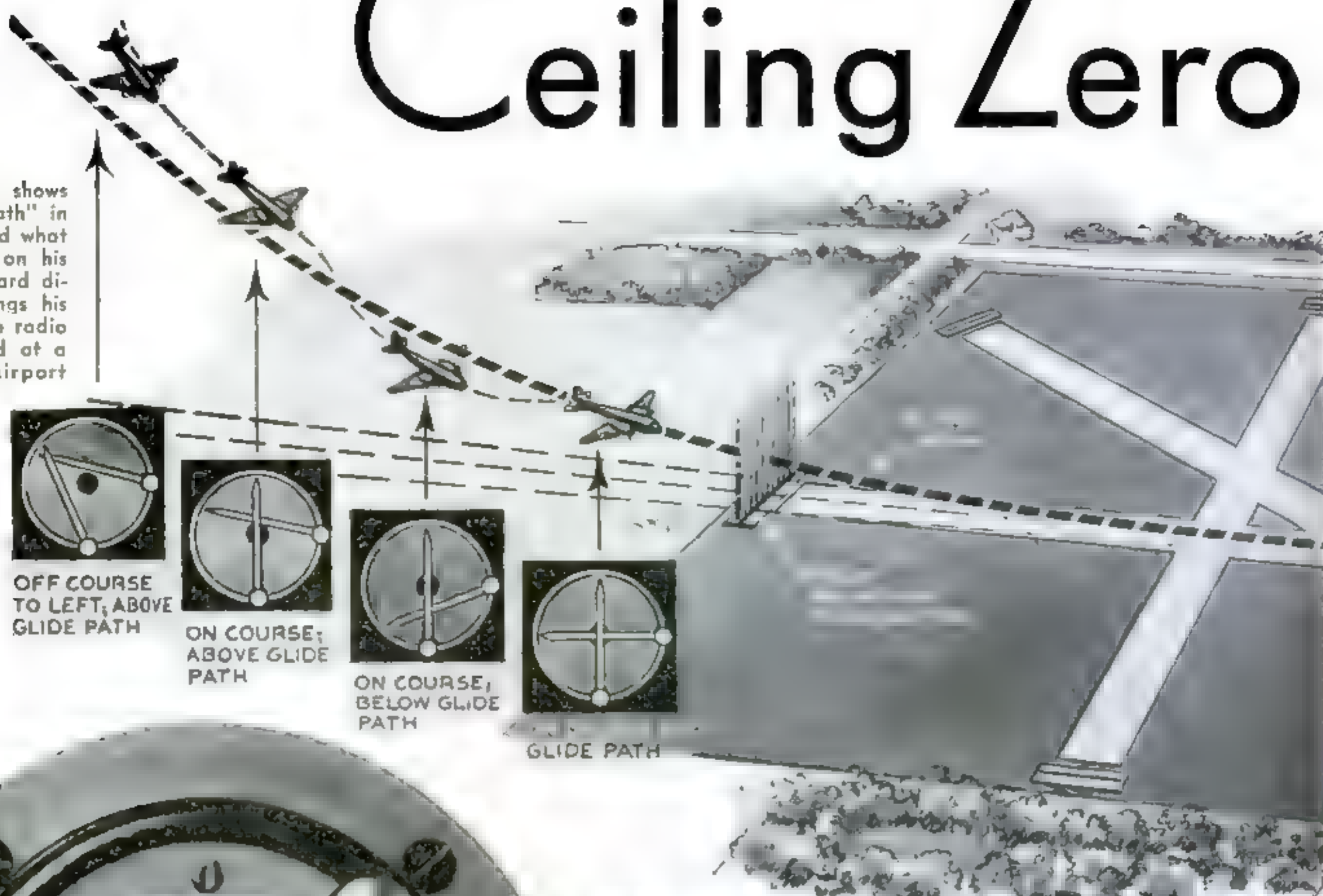


Simba, the cougar. This 170-pound Arizona mountain lion provided one of the greatest thrills that Keller has known

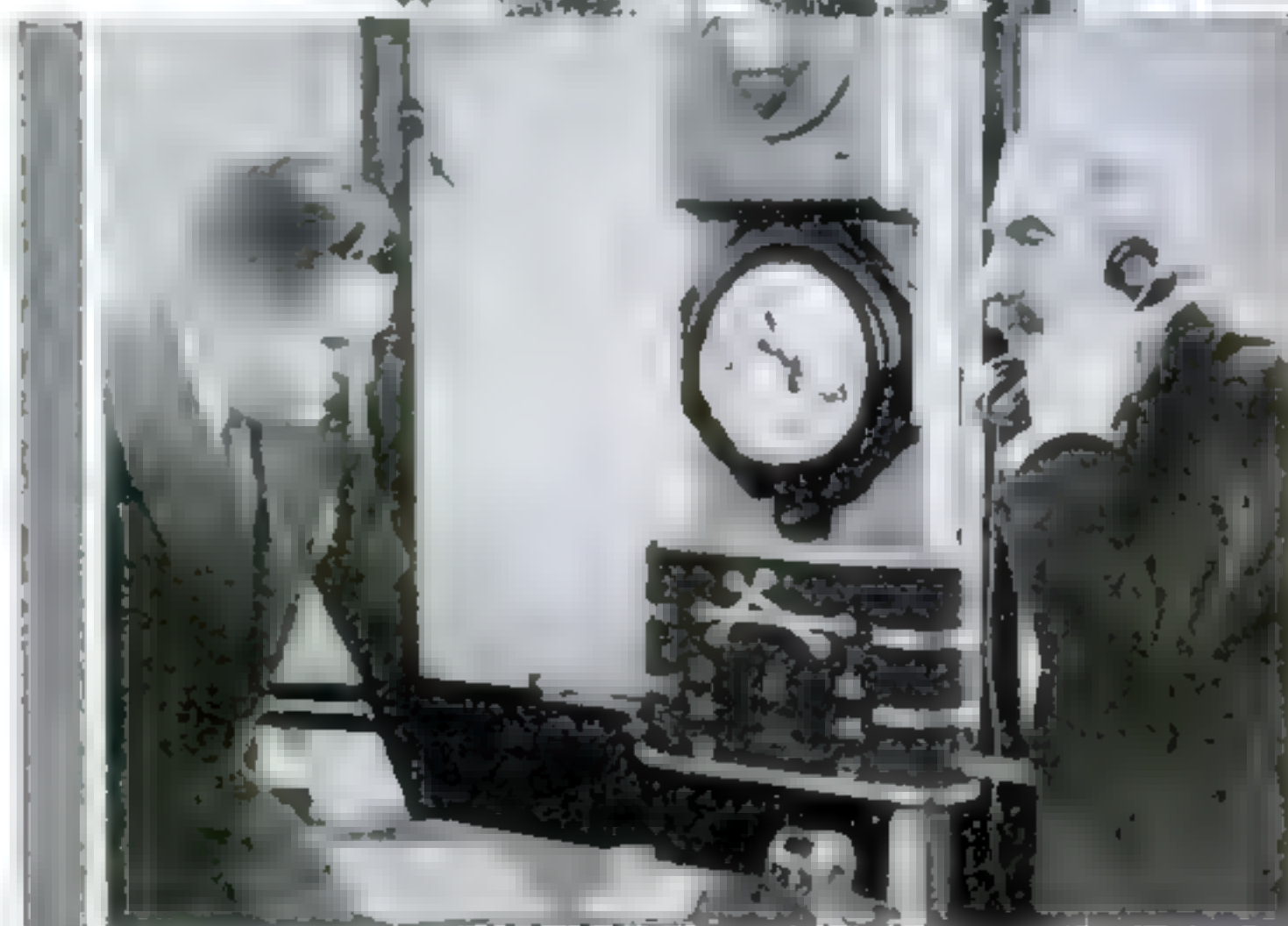


# Ceiling Zero

This drawing shows the "glide path" in operation, and what a pilot sees on his instrument-board dial as he brings his ship down the radio beam to land at a fog-bound airport



The vertical pointer shows whether the plane is to right or left of the beam, the horizontal one whether it is above or below



Men in the control tower of the airport order the mobile transmitting unit into action to assist in making the blind landing

By **ROBERT E. MARTIN**

**W**INGING its way through leaden skies, a great airliner is making port. Up forward, the copilot picks up the microphone of his two-way radio and asks for a weather report. "Ceiling zero—visibility zero!" comes the voice of the radio operator at the airport control tower.

Fog has suddenly rolled across the landing field, blotting out runways and hangars in a white pall through which the plane must dive to earth. Now it must be a blind landing, guided only by the dials on the pilot's instrument board.

Experimentally, the feat has often been performed by Army, Navy, and commercial flyers. Now, for the first time, passenger-carrying airliners on regularly scheduled flights are doing it. A few weeks ago, at Pittsburgh, Pa., a transport plane successfully inaugurated a radio blind-landing system perfected for the purpose after ten years of experimentation by experts of the Washington Institute of Technology, the National Bureau of Standards, and the Bureau of Air Commerce.

The heart of this new system is a radio transmitter housed in an auto trailer. Allowing ample time before a plane is scheduled to arrive at the airport, a runway is chosen that will al-

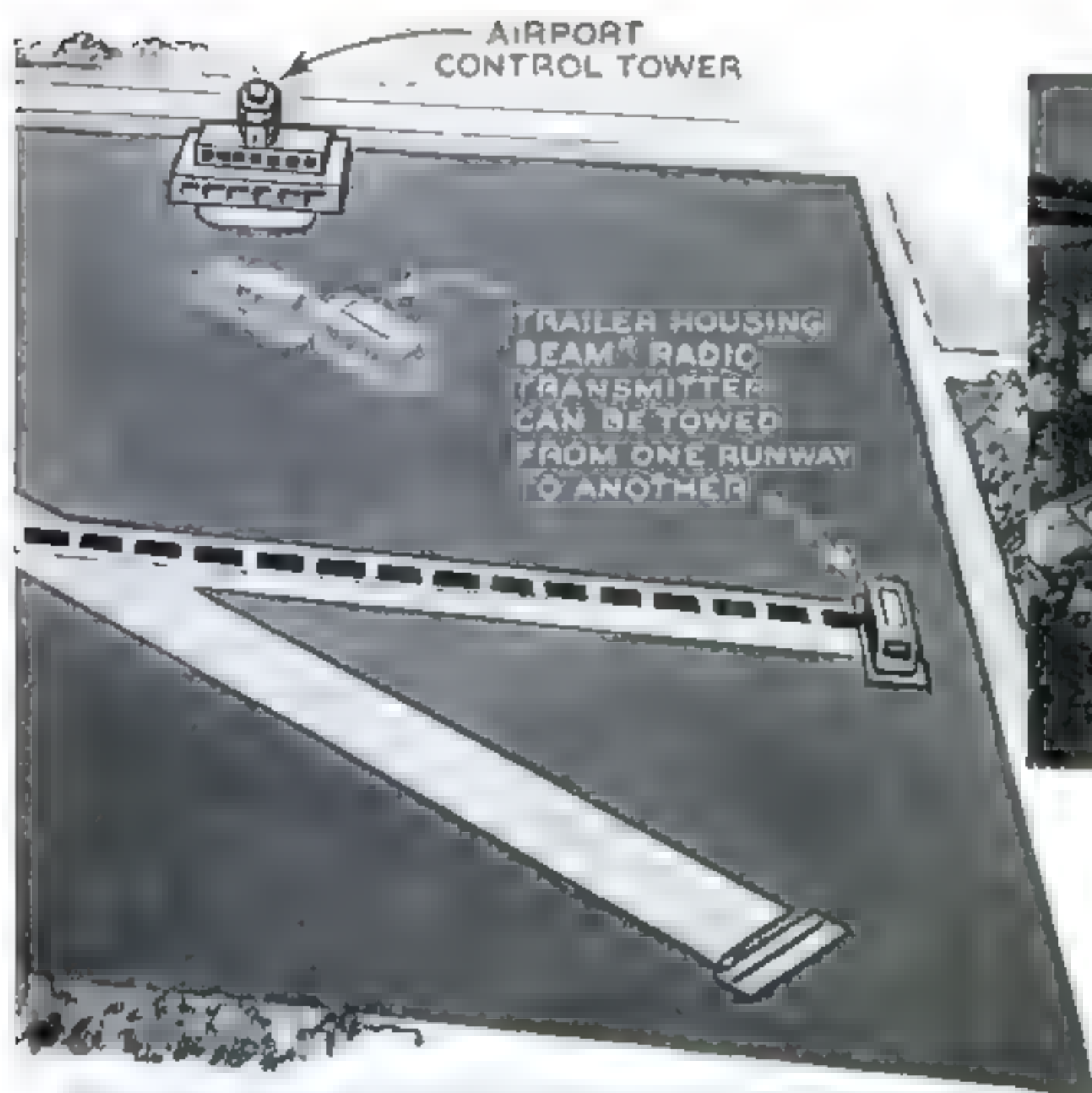
low it to land into the wind, and telephoned instructions from the control tower dispatch the trailer to this end of the field. Along the direction of the runway, the transmitter projects directional radio signals in what is called a "course beam."

Twenty miles from the airport, a pilot who has been following the regular long-range radio beacon first picks up the local "course beam." A vertical pointer on an instrument-board dial shows him whether he is flying to the left or right of it by swinging in the corresponding direction, and the pilot corrects his course accordingly.

Four miles from the airport, a horizontal pointer on the same dial comes



# NEW RADIO SYSTEM GUIDES PLANES TO BLIND LANDINGS



In the cockpit of the incoming plane, the co-pilot receives a weather report from the radio operator of the airport, below. Fog has closed in. "Ceiling zero—visibility zero" comes the warning. The plane must make a blind landing, by instruments only



The trailer housing the radio-beam apparatus is towed to the end of a runway on which the plane can land into the wind

into play. By rising or falling, it indicates whether the plane is above or below a curved "glide path," marked by constant intensity in a field of radio waves projected by the trailer, and leading down to the earth from an altitude of 1,500 feet at just the right gliding angle.

Keeping the two pointers centered, the pilot thus heads his plane for the runway at the proper rate of descent, just as if the craft were coasting on trolley wheels down a guiding cable. A final radio warning from a fixed "marker beacon" at the boundary of the field—a tone signal in his earphones, and a flashing light on his instrument board—tells him that he is about to land. A few seconds later, the landing wheels gently graze the earth. After a brief run, the plane taxis up to the apron and the passengers disembark, brought safely to their destination by the magic of modern radio.



After gliding down on the runway, the big airliner taxis up to the apron and discharges its passengers. The blind landing has been made in safety

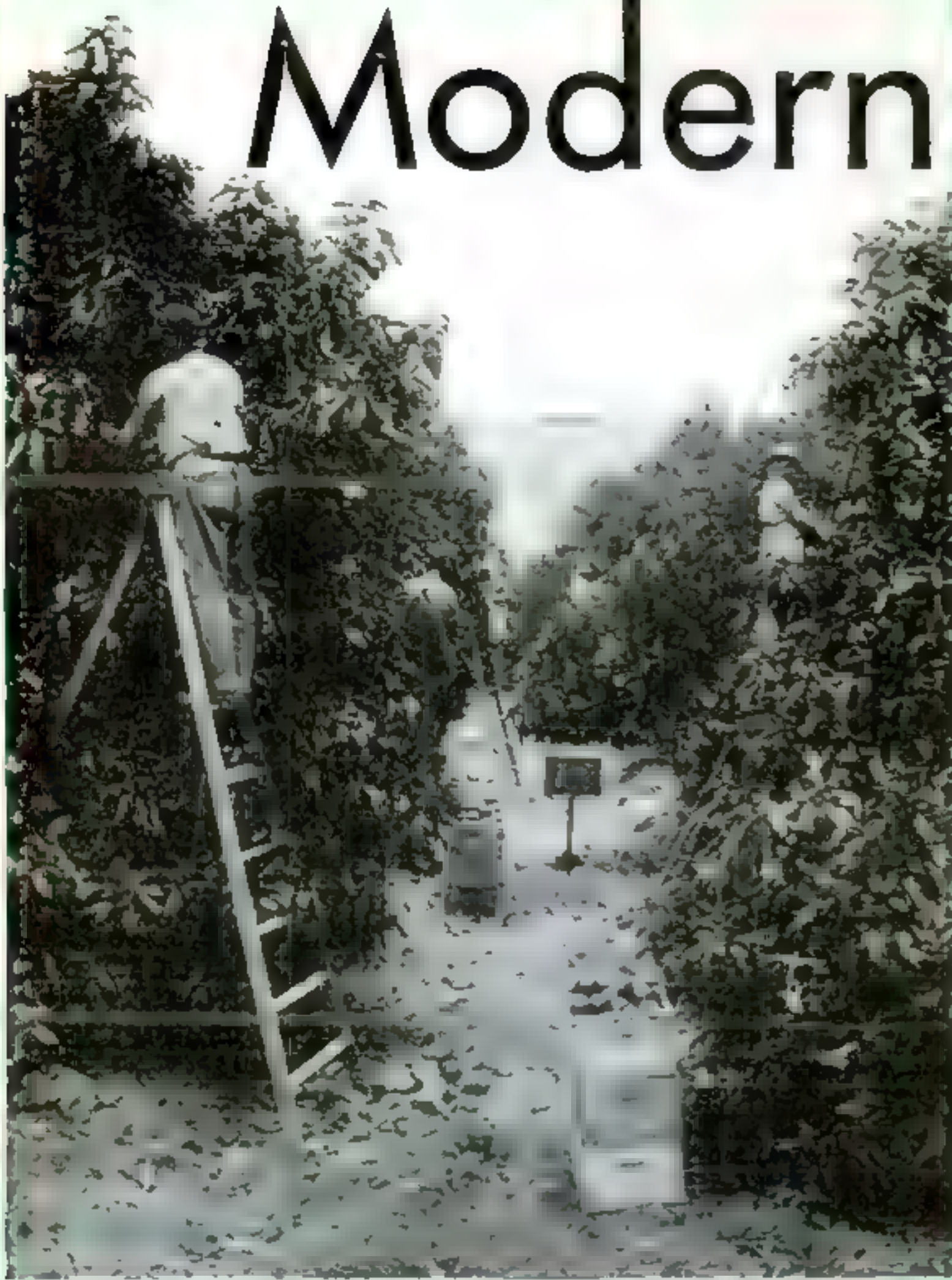


# Modern Avocado

Explorers, Scientists, and Growers  
Have Joined Their Efforts To Master  
the Strange Behavior of This Relic  
of Mayan and Toltec Civilizations

By

ANDREW R. BOONE



Workers gathering avocados in a California grove. At the right, chemists at the packing plant are testing sample fruit for its oil content



**F**ROM 15,000 acres of groves in Florida and California, 20,000,000 avocados, or alligator pears, will roll this year in refrigerated trucks and railroad cars to the markets of the nation. Although it was cultivated by the Toltecs and Mayas of Mexico and Central America, this delicious fruit is little understood today, even by the small group of scientists and growers whose patient efforts have brought it to your dinner table.

How the ancient Americans propagated avocados remains a mystery, yet this fruit, one of the few contributed by the Western Hemisphere, was cultivated hundreds of years before Columbus. The Toltec and Mayan civilizations disappeared nearly ten centuries ago, yet among their ruins wild and domestic avocados are found growing side by side—varieties differing as widely from each other as the wild apples of the Himalayas and the delicious apples of the United States.

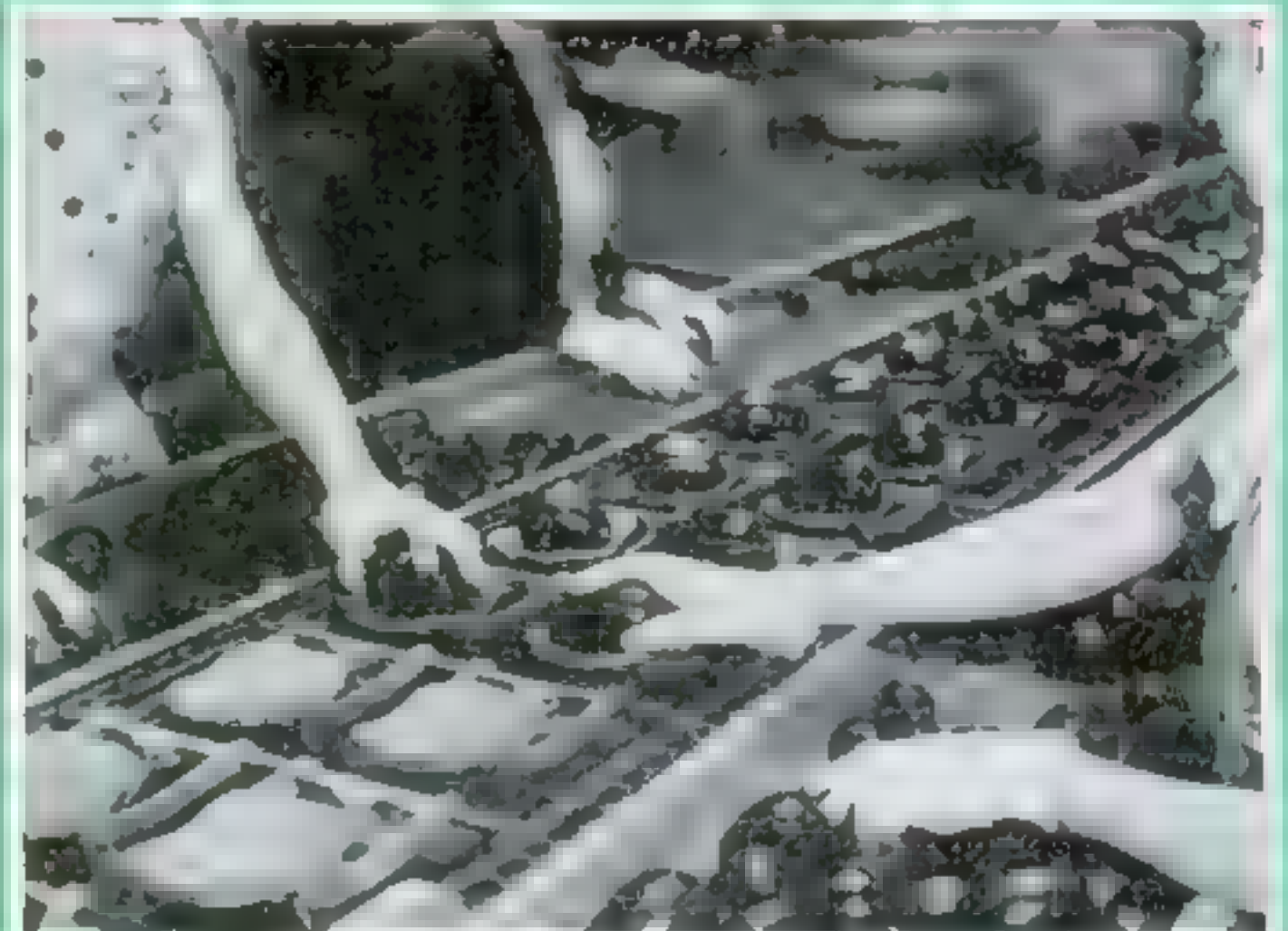
More than 30,000 varieties of avocados have been counted. Of these, 518 have been named and selected for experiment, and about two dozen kinds are being raised commercially in Florida, California, and Hawaii. And, in an orchard at the University of California in Los Angeles, avocado seed-

lings have been planted so that, for the first time in history, their mysterious life processes can be checked scientifically.

At the present time, there is no way of telling whether the seeds of a given variety of avocado will grow into a tree of the same type, or of an entirely different kind never seen before. Nearly all the avocados consumed in this country today are produced by grafting bud wood from trees of known quality, found by explorers in tropical and subtropical jungles, onto the roots of seedlings. And even with this foolproof method of controlling variations, the trees exhibit peculiarities that distinguish them from all other fruits.

In the first place, millions of blossoms form on each tree from Novem-

ber to May, in the climate of California. Of these, generally only a few hundreds will bear fruit, though sometimes a single tree will produce 35,000 avocados, with a total weight of four tons. Trees have been known to collapse under the weight of their fruit, but the average yield for each tree



Graders placing selected fruit in rubber cups on a conveyor which passes them under a machine to stencil on a brand name



# Groves

## BRING AN ANCIENT FRUIT TO YOUR TABLE

At the left, below, is an avocado seedling. Inset shows how bud wood from a tree of known quality is grafted onto a root stem



A scene in a California packing plant where avocados are prepared for shipment to all parts of the country. Easily bruised, the fruit are handled as carefully as eggs

scarcely touches 600 pounds in weight.

Each flower opens and closes four times during its lifetime, almost with the regularity of clockwork, changing sex three times in the process. Female organs mature first, and on the first opening the flower functions as a female. From six to twelve hours later, the female flower closes, and after twelve to eighteen hours, it opens once more, now a male. Some six hours later, the flower closes again, waits a half day, and reopens as a female. And

again, it closes, reopens as a male, closes—and, providing it has become pollinated meanwhile, proceeds to set fruit.

This rhythmic opening and closing suggests that the flowers cannot pollinate themselves. But Dr. Robert W. Hodgson, of the University of California, has discovered that while females usually mature in the morning, some male flowers are open at the same time. Unlike dates, for which fertilization must be undertaken by hand (P.S.M. Nov. '36, p. 22), avocados are fertilized by bees and other insects which carry pollen from flower to flower on their bodies and legs.

Trees blooming in March or April yield their fruit the following year. If the blossoms appear in April, the fruit ripens in July of the next year. Thus, most of the fruit hangs on the tree longer than a year, requiring almost two seasons to ripen. After picking, the fruit must soften at room temperature.

Avocados are most like olives in that they possess high oil content. They are akin to meat in containing protein. Yet they really are a "butter" fruit as to consistency, composition, and flavor.

Oddly, they bear abundantly in alternate years. This is particularly true of the Fuerte, the commonest of all the California varieties. Science today seeks the answer to this horticultural riddle.

"We know," Dr. Hodgson told me, as we examined the tiny seedlings, "that two and one half times as much energy is required to manufacture oil as carbohydrate. Also, plants must first manufacture carbohydrates, then convert them into oil. This may be related to irregular bearing, the new industry's biggest production problem."

For five years, Dr. Hodgson has sought the key to this mystery, with no positive results so far. The best science can do is to predict each year's crop on the basis of last year's production and the current weather. Favorable weather in an "on-crop" season, or one following a lean year, promises a bumper yield, while unfavorable weather in an "off-crop" season spells failure.

Meanwhile, he has found that gir-  
dling of *(Continued on page 128)*



This machine stamps a brand name on each fruit. Right, avocados rolling off the conveyor into a bin, the floor of which lowers itself to keep the pile at the same level





Radio-controlled model plane, and the transmitter that directs its flight



## Radio-Directed Plane Is Gunners' Target

FLOWN under radio control, a gasoline-powered plane of twelve-foot wing spread has just been completed by two California model makers to serve as an experimental target for artillerymen. If trials prove successful, similar planes may be used for antiaircraft training. While the pilotless craft is in the air, impulses from a ground transmitter operate its rudder and elevator controls, through a receiver installed in its miniature fuselage.

## Glove Ends Thumb-Sucking



By adding imitation fingers of rubber to fingerless mittens, an inventor has produced gloves that not only prevent a baby from sucking his thumb, but also provide an agreeable substitute. The flexible tips are declared to satisfy the child without any harmful effects.

## Sun's Heat Used To Generate Gas for Fuel



**N**O WORRIES about gas bills trouble Otto H. Mohr, of Concord, Calif.—for he harnesses sunshine to provide himself with a free supply of gas for his kitchen stove. Applying a principle hitherto tried only on a laboratory scale, he concentrates the sun's rays upon a "thermoelectric generator" that converts their heat into electricity. Then he uses the electric current to decompose acidified water into oxygen and combustible hydrogen gas. The supply of gas is reported sufficient not only for cooking but also for house-heating purposes. In previous experiments (P.S.M., Oct. '35, p. 30), Mohr has employed solar boilers of his own design to furnish power for house-cooling systems.



Otto H. Mohr lighting a jet to test sun-made gas. Above, the fuel generator and frames that concentrate solar heat

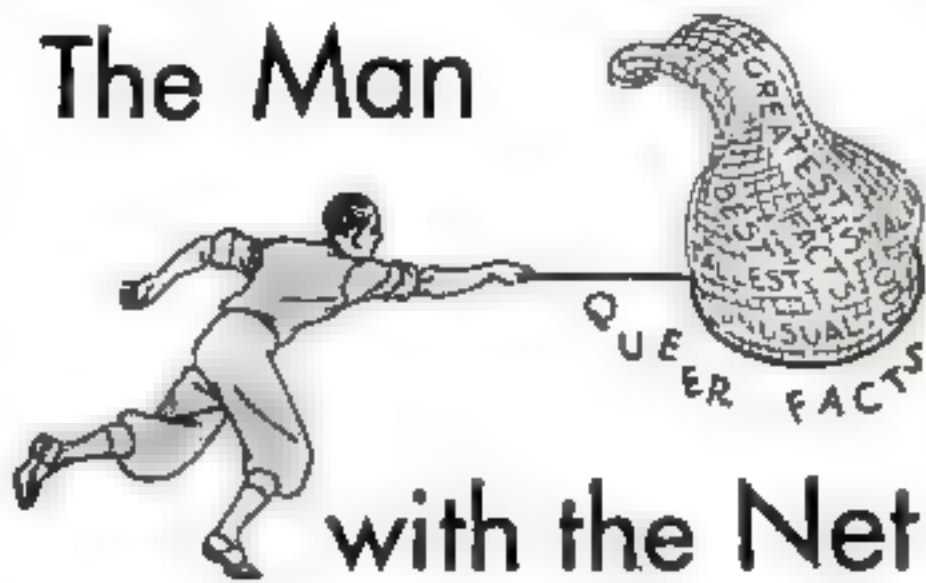


## Skate Wheels on Sled Give Summer Coasting

ROLLER SKATES that can be taken apart, devised by a Maspeth, N. Y., inventor, permit the use of their wheels to transform an ordinary sled into a vehicle for summer coasting on the pavements, as shown above. After being set in place, each pair of wheels is firmly clamped to the runner of the sled by a few turns of a standard skate key. At any time, the roller skates may be reassembled and used in the customary way.



## The Man



## with the Net

POTATOES belong to the same family as the deadly nightshade.

ALFALFA salad was served not long ago at a banquet in El Paso, Tex.



ALUMINUM-COLORED typewriter ribbons are now made for use with dark shades of paper.

BETTER seven inches long—two thirds the length of this column—grow in the West Indies.

COFFEE cools your toes. Delicate instruments show the skin temperature drops temporarily after the beverage is drunk.



RATTLESNAKES possess delicate "heat detectors" on their heads which enable them to determine their nearness to warm-blooded prey.

TEN INCHES of snowfall equals approximately one inch of rain.

WEAKEST SOUNDS in the English language are "S" and "F".

EACH human body, it is estimated, contains a microbe population equal to 1,000,000,000 times the whole human population of the earth.

GOSH, OVER A BILLION!



THINKING CELLS of the human brain are placed near the outside; in the brains of the lower animals they are located on the inside.

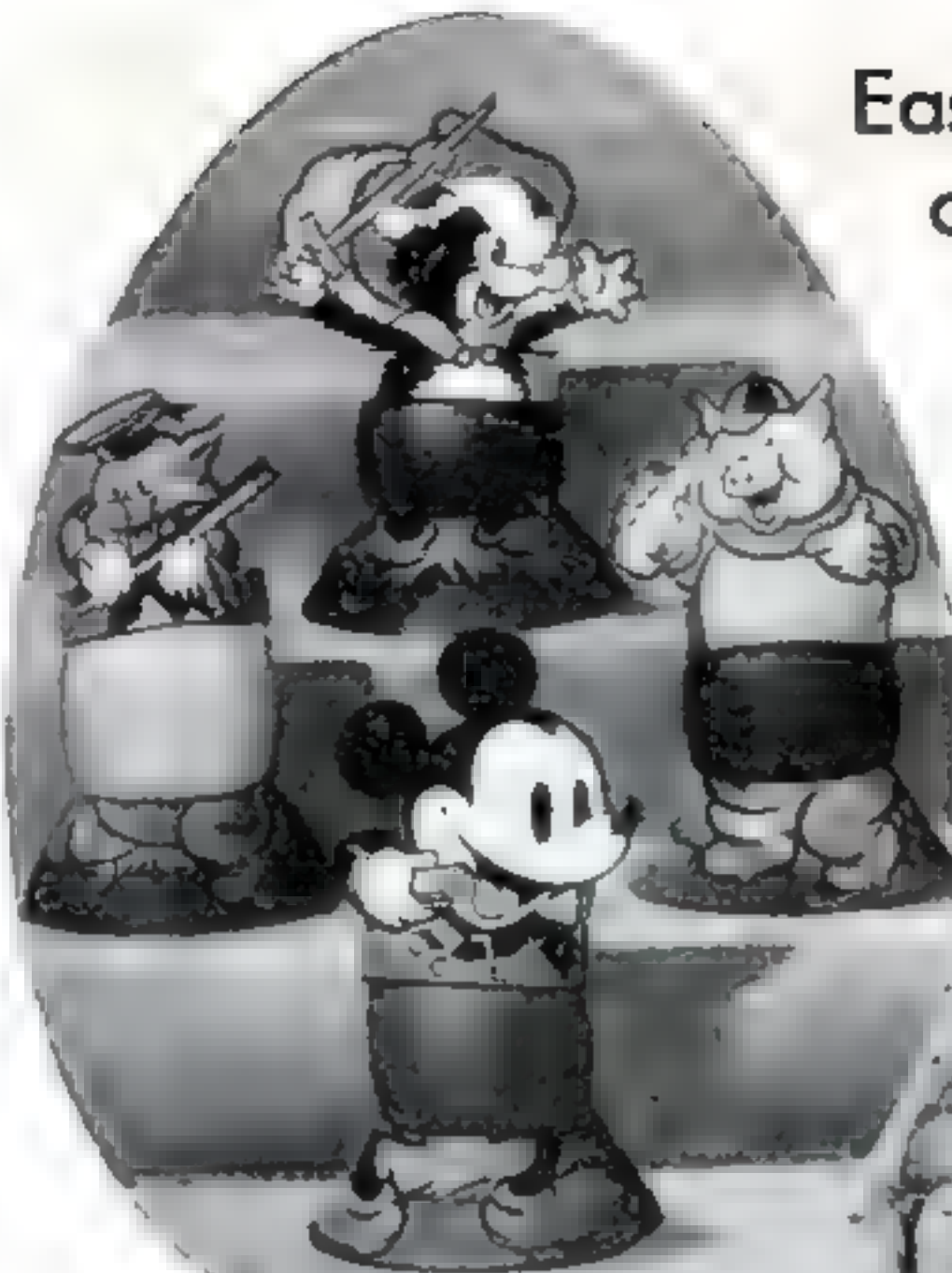
"FISH WOOL," a textile material being made in Germany from cellulose and fish albumen, is said to be as warm as sheep's wool.

ANTEATERS don't eat ants as a rule—they eat termites.

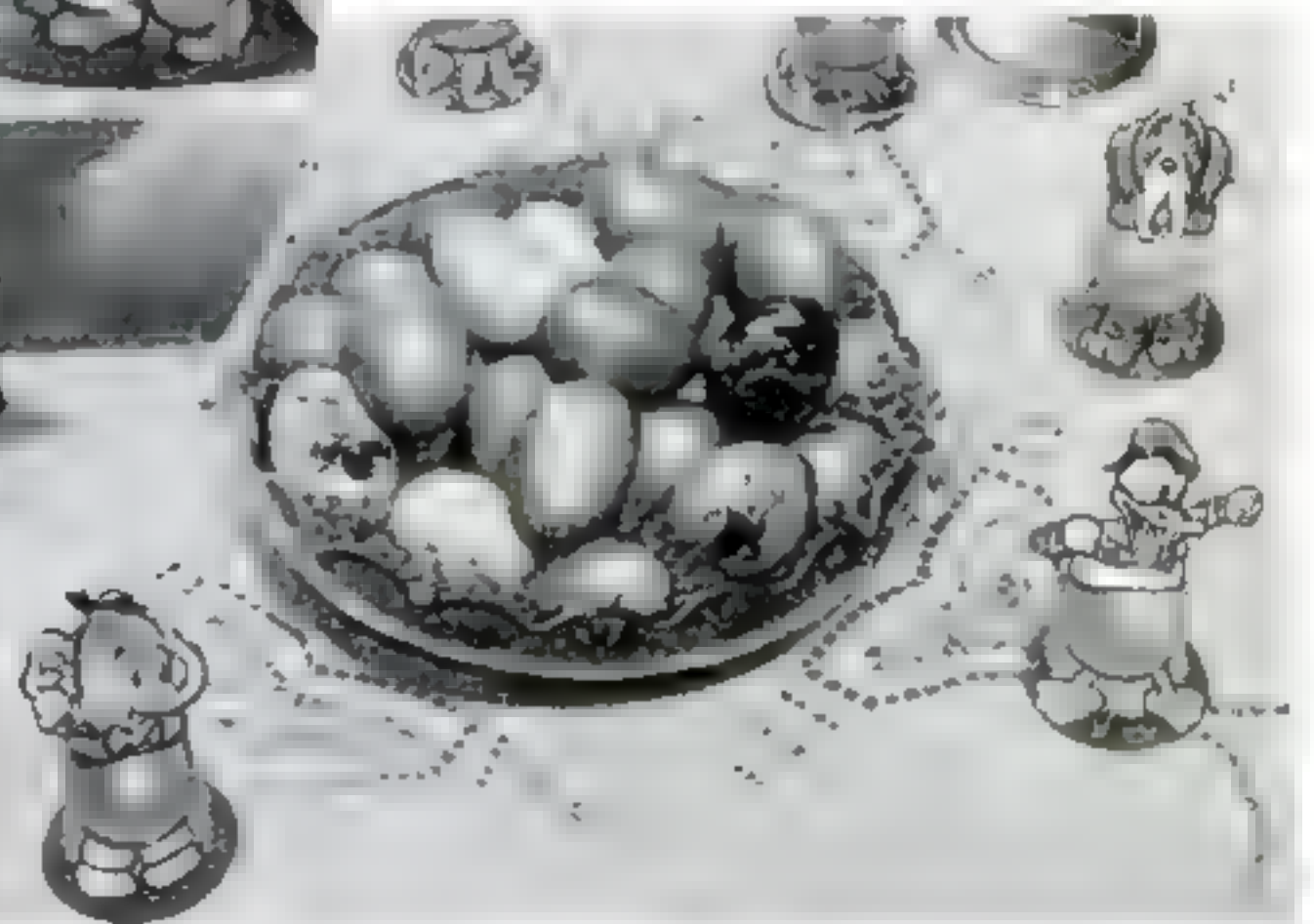


## Easter Eggs Masquerade as Cartoon Characters

EASTER EGGS may be transformed into likenesses of cartoon and nursery-tale characters, with attractively colored cut-outs now available in book form. Each design provides both a base and a headpiece for a tinted egg, as shown, and the book contains materials for dressing up twenty eggs in different guises.



Cut-out bases and headpieces transform these Easter eggs into familiar nursery characters. At the right, the figures are seen as party favors.



## "Gun" Sprays Powder To Reveal Fingerprints

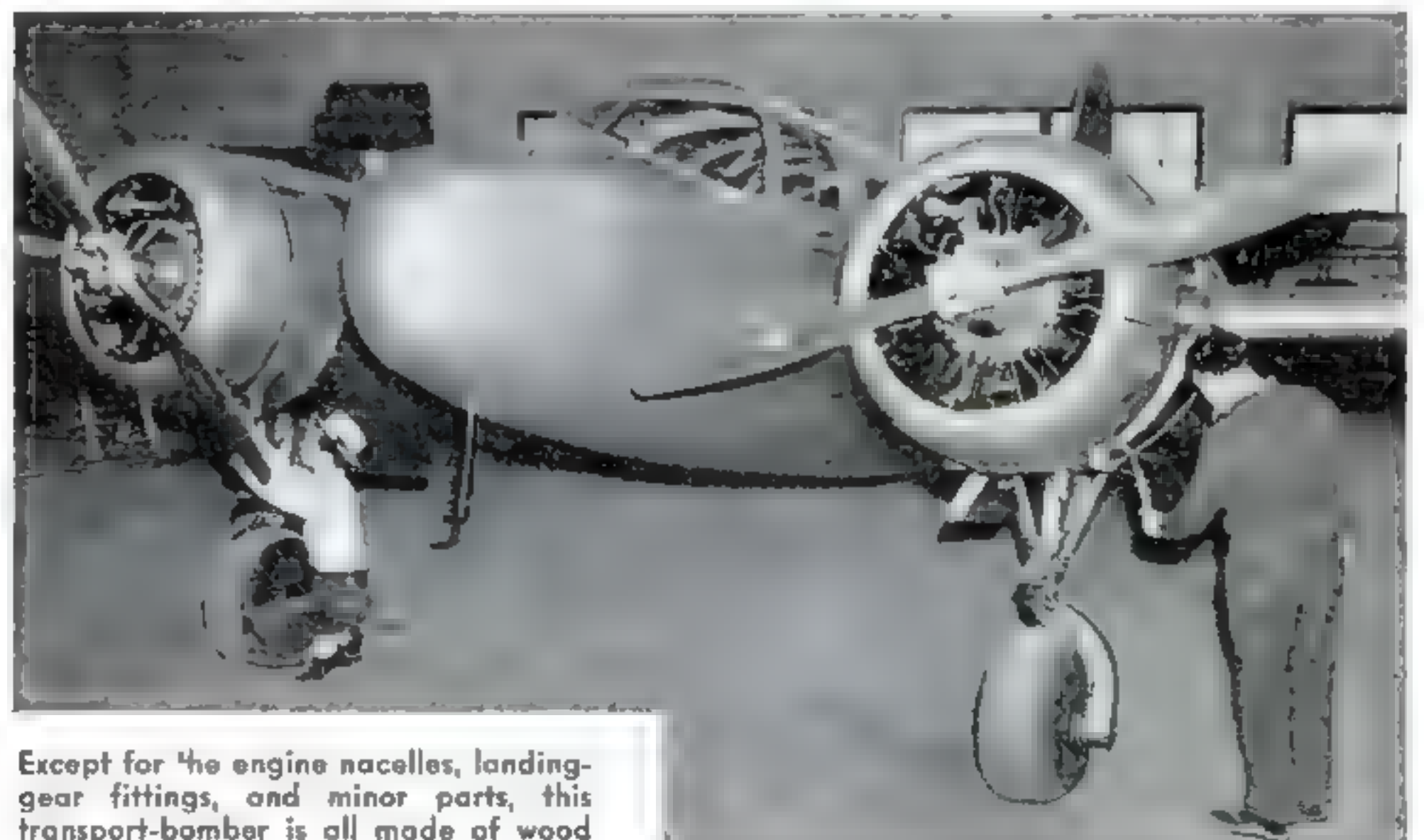
SPRAYING powder instead of bullets, a novel "gun" has been devised to trap criminals by making latent fingerprints visible. Interchangeable chambers permit any desired powder to be fed into the implement. A blower operating on house or battery current directs the powder upon the surface to be searched.

## Big Transport Plane Is Built of Wood

BUILT almost entirely of wood, a convertible transport-bombing plane just completed in California represents a radical departure from modern all-metal design. The new type is declared to be capable of better than 200-mile-an-hour speed.



Electric blower dusting latent fingerprints



Except for the engine nacelles, landing-gear fittings, and minor parts, this transport-bomber is all made of wood



# Pygmy Racing Cars Meet in Miniature Sweepstakes



Model speedsters at the starting post for a race on the floor of a garage. Rubber bands drive them

MIDGET automobiles vie in thrilling races staged by British model-making fans, who are shown in the illustration at the start of one of the contests held in a London garage. The models range in length from six inches to two feet, and are driven by strands of rubber elastic. Speeds up to forty miles an hour are reported to have been attained. Some of the model builders have provided their cars with spring bumpers to protect the speeding racers from damage if they should collide with others or with a wall. So popular is the new sport that a model-car racing association has been organized to hold meets for enthusiasts.



## Odd Electron Furnace Melts Stubborn Metals

APPLYING a new principle to attain temperatures up to 4,500 degrees F., an "electron furnace" devised by Dr. Ralph H. Hultgren of Harvard University easily liquefies hard-to-melt metals such as platinum, iridium, and palladium. Closed with an air-tight cover as shown above, it maintains an almost perfect vacuum while speeding electrons from a pair of electric filaments bombard a crucible positively charged to 2,500 volts. The energy of their impacts is transformed into heat.

## Individual Train Tickets Printed to Order

ALL the various tickets used by subway riders of London, England, according to their destinations, will soon be printed to order by ingenious machines installed in the underground booths. Formerly prospective passengers could be supplied with tickets at a rate of only eight a minute, while twelve tickets a minute can be sold by a clerk using the machine method.



Using this new machine, a clerk can sell twelve tickets a minute

## Dummy Gas Tank Shows Short-Measure Sales



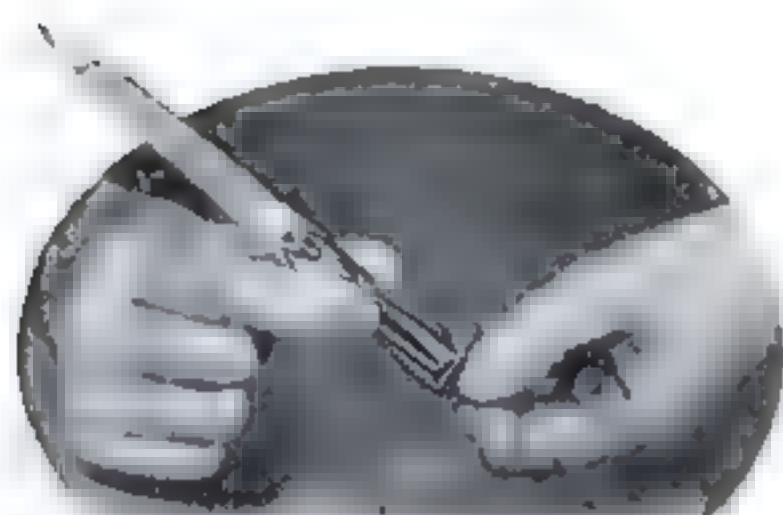
Folse tank removed from car for measuring gasoline pumped into it

STOPPING at a gas station, an inspector of New York City's Department of Markets may have several gallons put into a dummy tank on his car. Detaching it, he promptly empties it into an accurate measuring can to make sure that full measure is being given. When the inspector really wants gas for his car, a secret tank is filled through the spare-wheel hub.



## Nail Clip and File Are Combined

NAIL CLIP and straight file are combined in one convenient vest-pocket unit that is now available. The clipper, attached to one end of the file and forming the handle, is used to give the finger nail the general outline desired and the file to smooth out any rough edges. The accessory is pictured in use in the photograph below.



One end of the tool clips the nails, and the other smooths rough edges

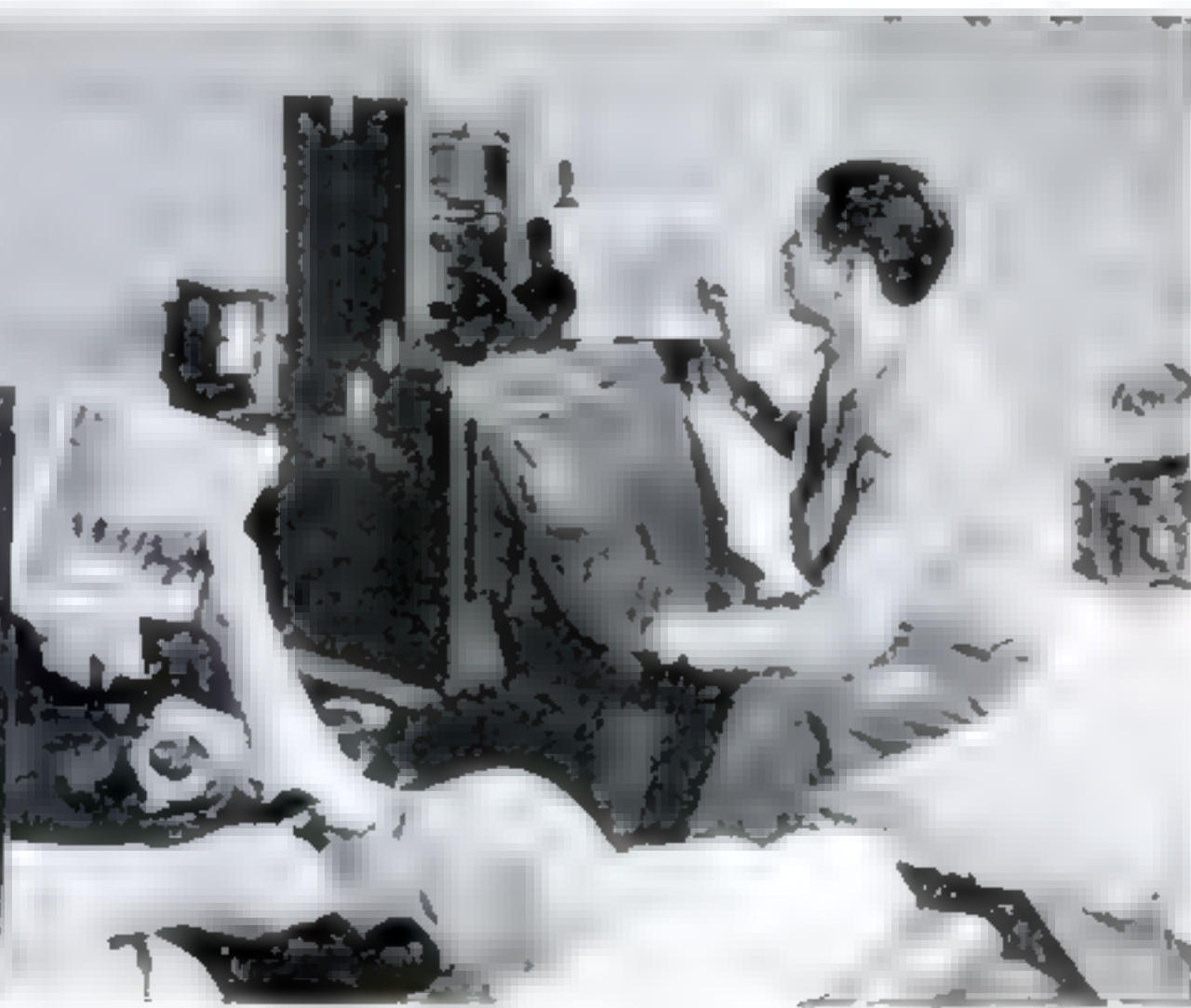
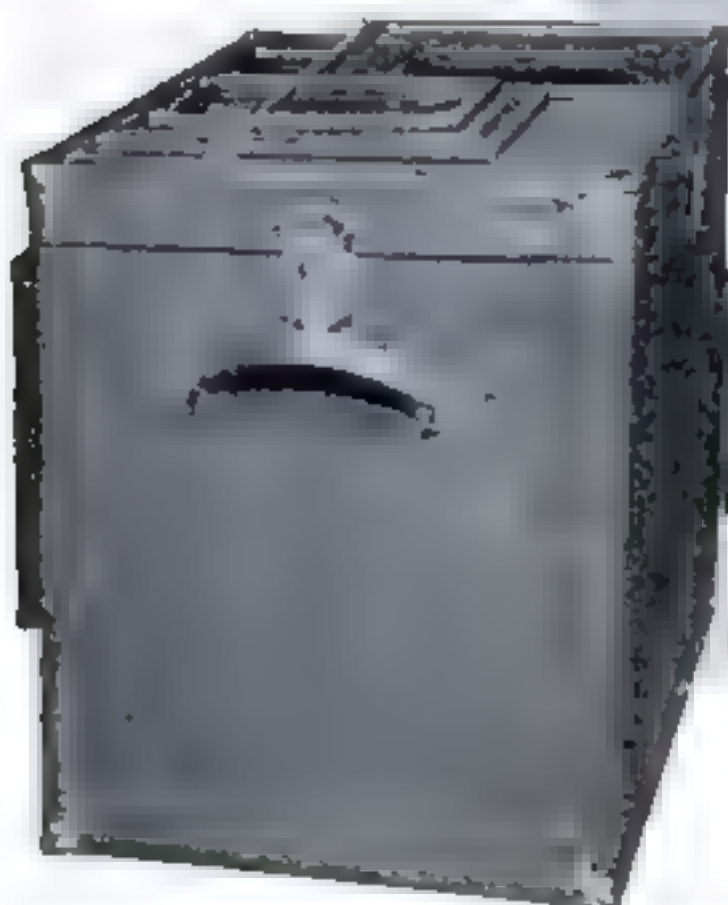


## "Sand Buggy" Uses Old Automobile Parts

FRONT seat, axle, and wheels of an abandoned automobile were made into the novel vehicle shown in the photograph above. The two-wheeled cart is said to be particularly efficient for carrying heavy loads over the sandy woods

trails of western Florida, since the tires prevent the wheels from sinking into the loose sand. An automobile maker is said to be considering the manufacture of a four-wheeled "sand buggy."

Right, news photographer developing and enlarging pictures "on the spot" with the handy portable darkroom outfit below



## Portable Darkroom Develops and Enlarges Photographs

PHOTOGRAPHS can be developed and enlarged right after they are made, with a portable darkroom invented by Ennis C. Helm, Oklahoma City, Okla., news photographer. Weighing only twenty-five pounds, the unit is not much larger than a suitcase. Stainless-steel developing tanks within the leather-covered

case are surrounded by water jackets for keeping the developing solutions at the desired temperature. Current for the printing and enlarging lamp may be drawn either from an automobile battery or from a standard 110-volt circuit. Enlargements up to five by seven inches can be made in the portable unit.

## Toy Goalies Swat Puck in Ice-Hockey Game

PLAYED on a board representing a rink, a novel ice-hockey game provides many of the thrills of the actual sport. Knobs at the ends of the board operate steel manikins which swing around to strike a ball with their sticks as each player tries to drive it into his opponent's goal. The steel playing board is sturdily constructed.



Each player tries to make his toy "goalie" knock the ball past his opponent's guard

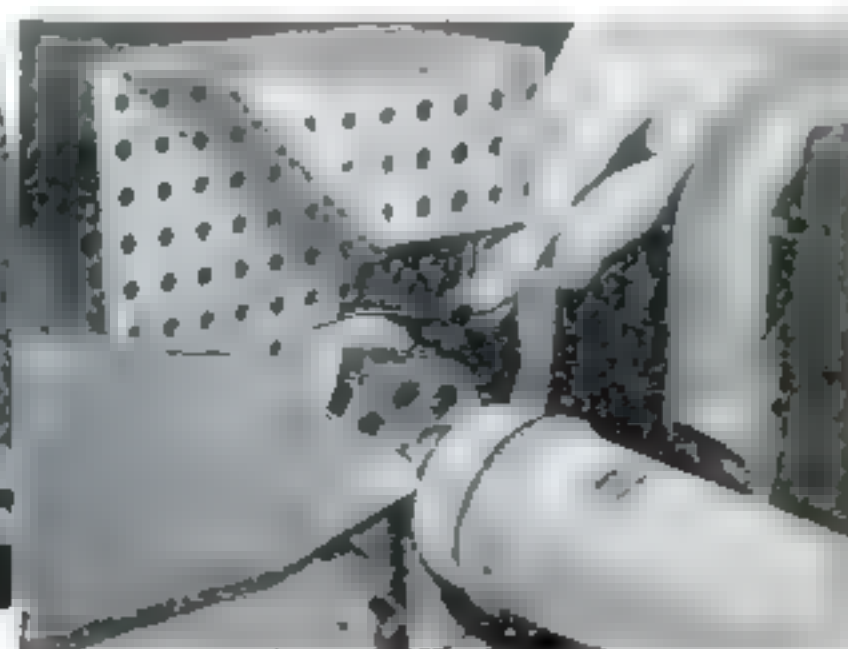
## Now You Can Chew a Cup of Coffee

CUPS of coffee in chewing-gum form are a new confection now on the market. Real coffee essence is used to flavor the gum, so that it tastes like black coffee and is said to produce the same stimulating effect as a cup of the beverage taken in the usual liquid form.



## Telegraph Kisses Are New Fad

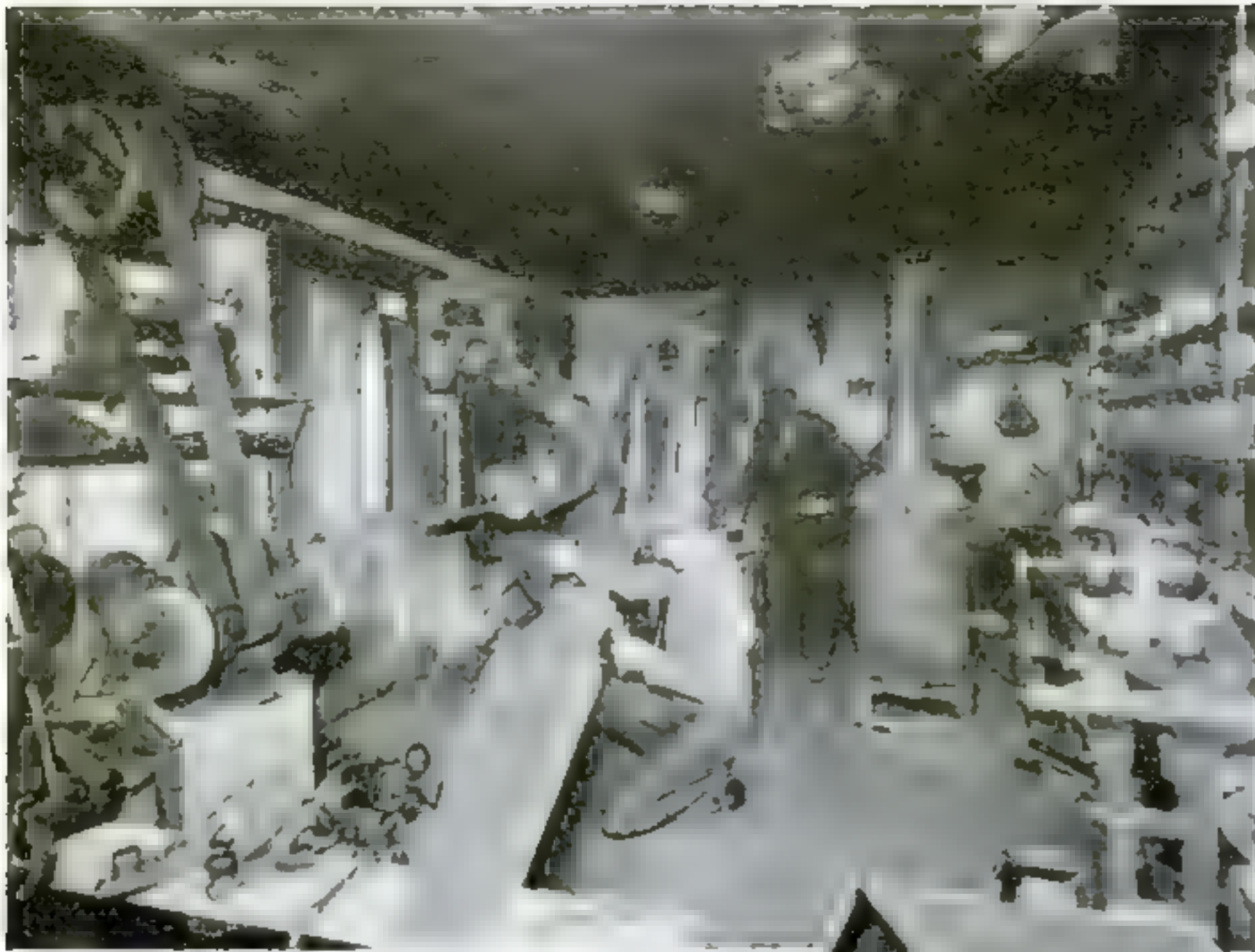
SENDING kisses by wire is a new use for facsimile telegraph transmission. Recently a New York girl kissed a telegram blank and the lipstick impression was placed on the facsimile transmitter, as at left, to be reproduced for delivery in Chicago.



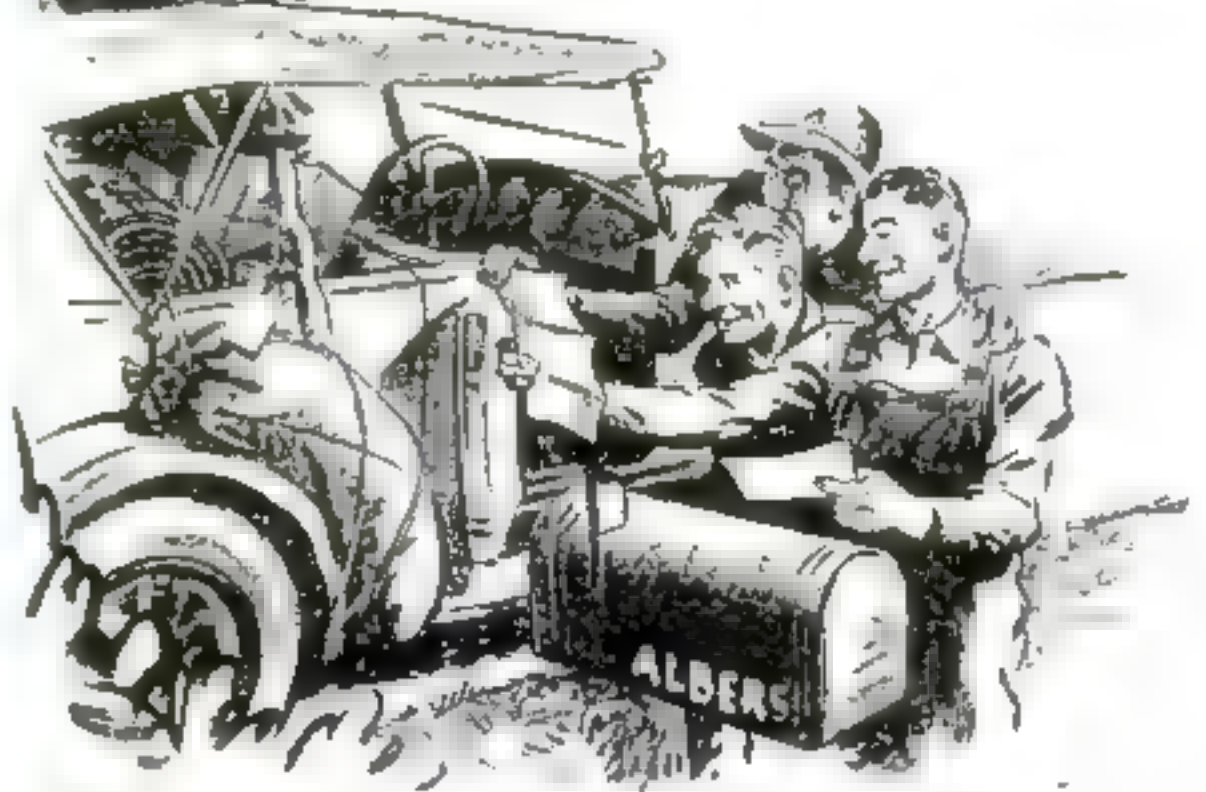


# Riches

HOW TWO BOY



The Albers brothers at work with their father in the home workshop of their farm in Iowa



Soon the rural mail carrier was bringing about ten orders a day



**T**HREE YEARS AGO, one of America's largest makers of radio sets got what seemed to be a brand-new idea. He thought it might be possible to use some sort of windmill generator to provide electricity for operating radio receivers on farms remote from power lines. He put an engineer to checking the scheme, with instructions to visit all makers of farm windmills to see what he could find.

Next morning the engineer was back, his eyebrows still arched in astonishment at what he had learned. "From all I hear, this idea has been worked out already by somebody in Iowa," he told the boss. "I'm going to Sioux City to have a look."

Two mornings later he returned, more

amazed than before. "You'd better go to Sioux City," he insisted with suppressed excitement. "There's a couple of farm boys out there who have this problem licked."

What the boss found when he went to Sioux City was a pair of brothers, John and Gerhard Albers. They were young fellows, obviously country-bred. And, in an astonishingly short while, they had become leaders of an industry which they themselves had created.

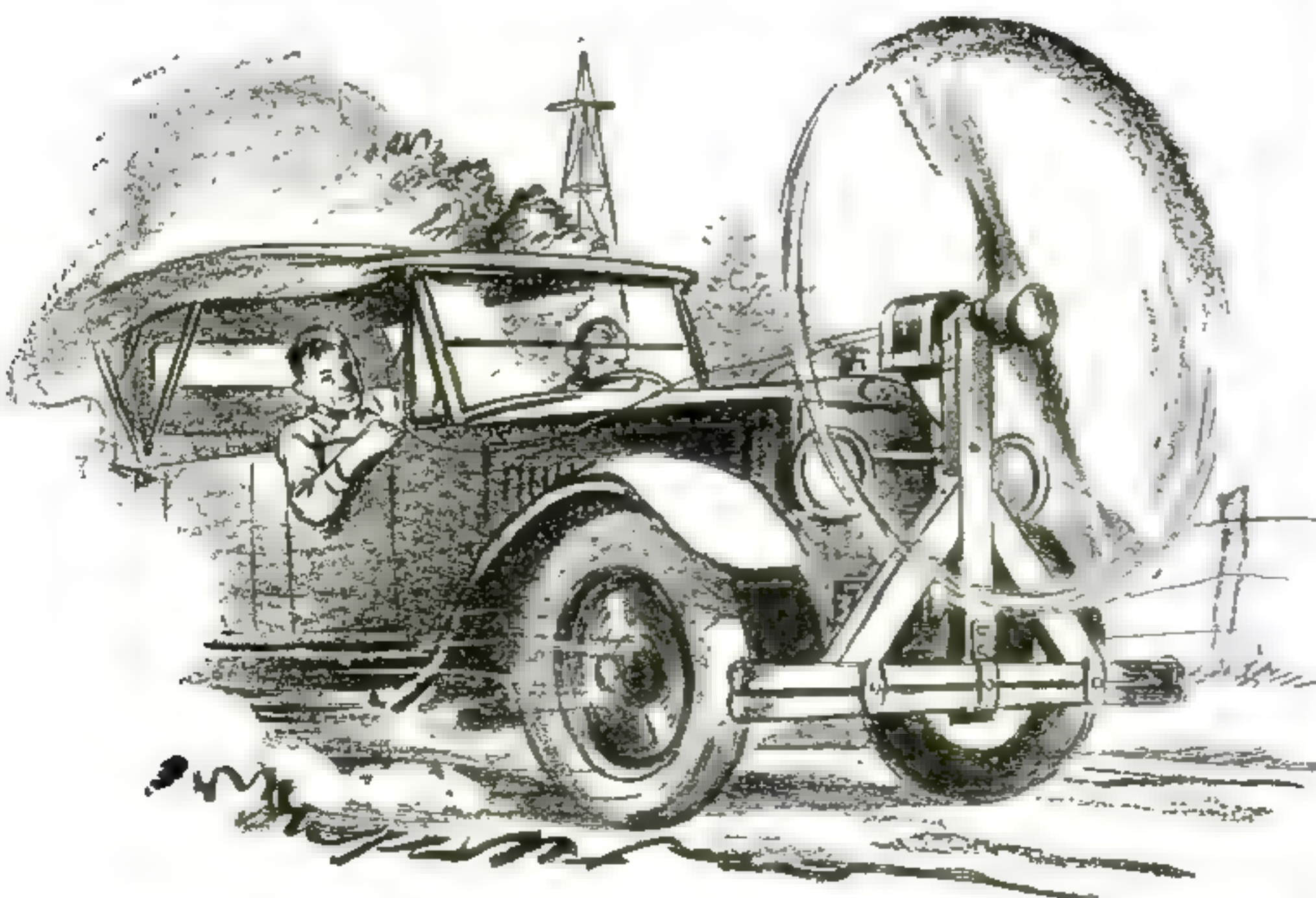
ing long enough to talk business with him. When finally he got them interested, it took him several days to buy a half ownership in their company.

Their windmill charger originated some ten years ago, when Gerhard was in his middle twenties and John was about ready for his first vote. On the farm, the family had a battery-powered radio set. Once a month it was necessary to take the battery over to the near-by town of Cherokee, pay the garage a dollar to charge it, and miss a couple of days' broadcasts. The boys begrudged the interruption, and their father could not spare the dollar. It was this simple set of facts that started them on the road to success.

The Albers farm boasted few books, but the boys liked to read. Gerhard used to call on a town girl whose father had a sizable library. Among these books was Fridtjof Nansen's "Farthest North," the explorer's record of his exploit in freezing his ship, *Fram*, into the ice above Siberia in the autumn of 1893 and drifting across the polar regions. In this book was the story—even to photographs—of a windmill on the *Fram's* deck, used to generate electricity. While the millionaires of New York City and Chicago lighted their mansions with gas, kerosene, or candles, Nansen in his icebound ship in the polar sea had been reveling in electricity.

Reading Nansen's book, these farm boys saw in the idea of generating electrical current by windmill a solution for the farm-radio problem. Stored away in the farm workshop was an old windmill which had been retired several years earlier. On a neighbor's farm stood a twisted tower from which a

By ARTHUR VAN VLISSINGEN



To test the efficiency of a propeller, they put it on the front of the family automobile



# from the Wind

## MECHANICS STARTED A BRAND-NEW INDUSTRY

storm had torn its mill. The neighbor would be glad to rid his land of the eyesore if the boys would take it away. They dismantled the tower, straightened the steelwork, and set it up again at the home farm with the discarded mill from their workshop. They got an automobile generator at a junk yard, and connected it to the windmill with gears from an old cream separator. The homemade contraption worked well enough to keep the radio battery charged, but it fell far short of suiting its builders.

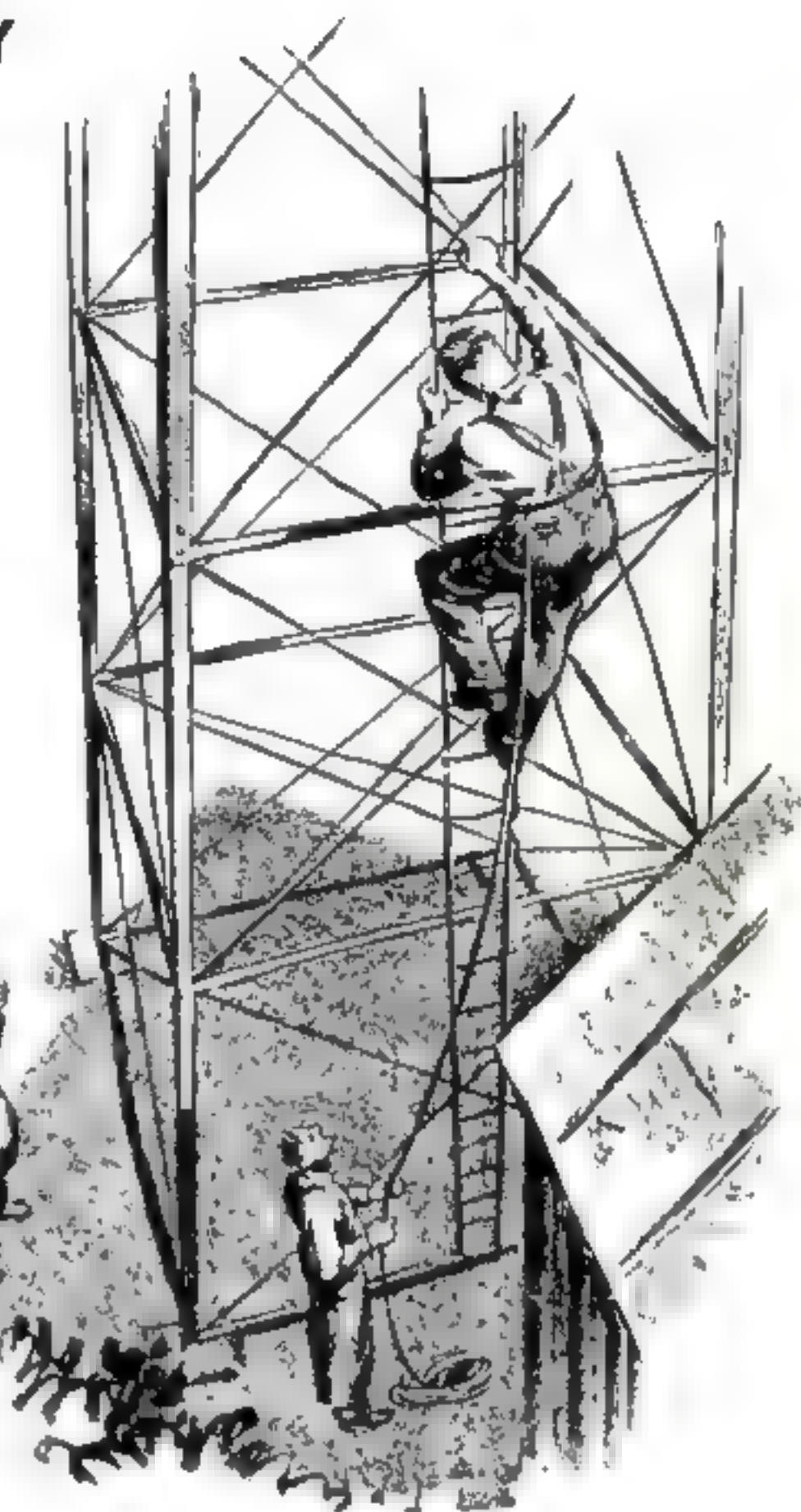
Even then, they were good mechanics. Their father had always been the neighborhood handy man, not for money but rather for the fun of it. When he needed helpers, Barney Albers drafted Gerhard and John. Because he loved mechanical jobs and therefore loved tools, he had accumulated a respectable assortment of machinery in his farm workshop.

The first need that these mechanically-minded farm boys saw for improving their charger was in the wind wheel. Farm windmills are designed for driving water pumps, and it takes a good breeze to start one of them. What was wanted was a wheel that would turn rapidly even in a light wind.

So they rebuilt the old windmill half a dozen times. Then John got the idea of reading up on aerodynamics. There weren't any textbooks on the subject around Cherokee, but the newsstands had lots of airplane magazines with articles on propeller design. Presently the boys were whittling out experimental propeller blades to apply the principles they had learned.

But how were they to know the relative efficiencies of these blades? They had no laboratory equipment such as wind tunnels, blowers, and anemometers. After a little thinking, they mounted the propeller ahead of the family automobile, hooked it to a junk-yard generator, and wired on an automobile ammeter. Then, to find the efficiency of a given propeller in, say a ten-mile wind, they drove up the road ten miles an hour, and drove back at the same speed. One brother steered the car while the other watched the instrument and recorded the electricity generated. The two-direction trip ironed out any inequalities due to wind, so that the recorded average showed just what the propeller would do. Even today, when they can afford any conceivable scientific equipment, and when they retain the foremost university laboratories as consultants in their work, they still sometimes resort to the old automobile road test.

Eventually, the Albers brothers developed a successful propeller which their magazine reading told them was definitely of airfoil type.



They dismantled the tower and set it up again on the farm

That is, the propeller turns not from the drive of the wind against its face, but from the pull of the partial vacuum against the back of the blade. They refined the design, literally by cut-and-try, until they had something so efficient that the wing tips of their present six-foot propeller travel thirteen times as fast as the wind that is making it turn around. *(Continued on page 116)*



John and Gerhard Albers with one of their outfits for generating electricity from the wind. At right, their factory at Sioux City, Iowa







John Ousta operating his simplified silk reeler in the parlor of his home. Right, skeins of raw silk

## American Silkworm Raiser Invents Reeling Machine

FOLLOWING several successful years of raising silkworms in the attic of his home (P.S.M., Aug. '36, p. 25), John Ousta, of New York City, has invented a simplified machine to reel silk from cocoons into skeins, a process heretofore requiring complicated machinery. Employing secondhand automobile parts for some of its mechanisms, the reeler shown in operation above is set up in the parlor of Ousta's home. All steps in silk production, the inventor believes, can now be carried on in this country.



Cocoons made by silkworms in New York City

## Wool Glued to Canvas Makes Novel Pictures



PAINTING pictures with wool is the novel occupation of Maria Pfeifer, a German artisan. On canvas stretched across a wooden framework, the artist pastes bits of wool thread of various colors to build up a realistic scene. The photograph above shows the wool-painter at work in her studio, with threads of different hues piled on a work table.



Frank and Donald Ross studying photography



## Solitaire Bridge Game Uses Automatic Board

ONE person can play four-handed bridge with a new automatic game board. As the player manipulates levers to bid and play his hand, the actions of his partner and opponents are automatically performed by the board. "Solitaire" bridge boards are shown above being used in a beauty parlor.

## "Twins" in School Are Not Related

TWO students in Rochester, N.Y., were born on the same day, have the same family name, and are identical in height, weight, complexion, and hair color, but are not twins and not even related. As a further coincidence, the unrelated "twins" both applied for admission to the same school on the same day to study commercial photography.

## Folding Fishline Drier Is Aid to Anglers

CLAMPED easily to any convenient support, a collapsible fishline drier just introduced is a handy accessory for anglers. Over a yard and a half of wet line can be wound at each turn around uprights mounted at the ends of two extension spreaders, as shown in the photograph at the right. All metal parts of the unit are treated to render it rust-proof. When not in use, the drier folds into a compact space.



This handy drying reel collapses into small space for carrying

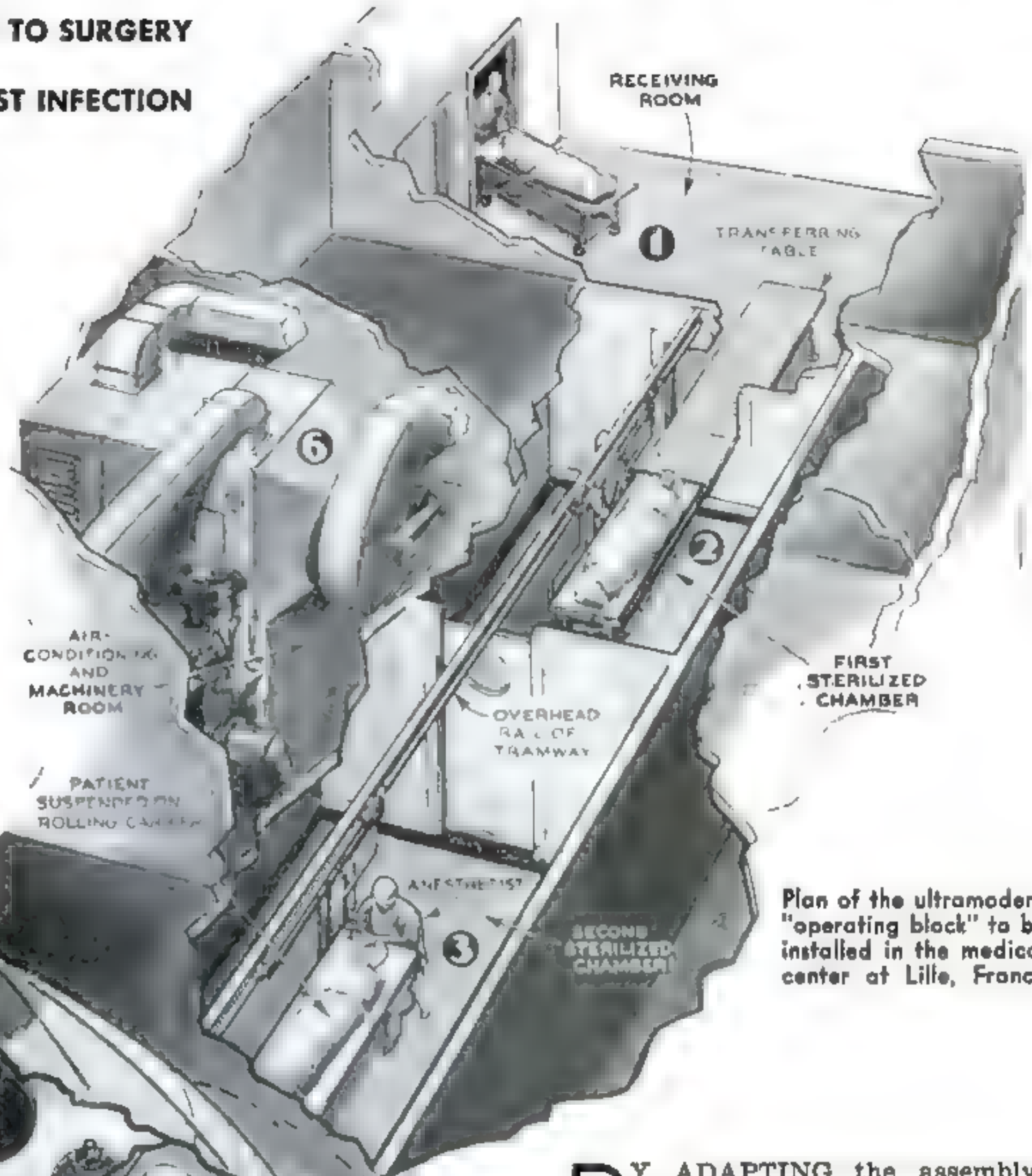


# Germproof Operating Room

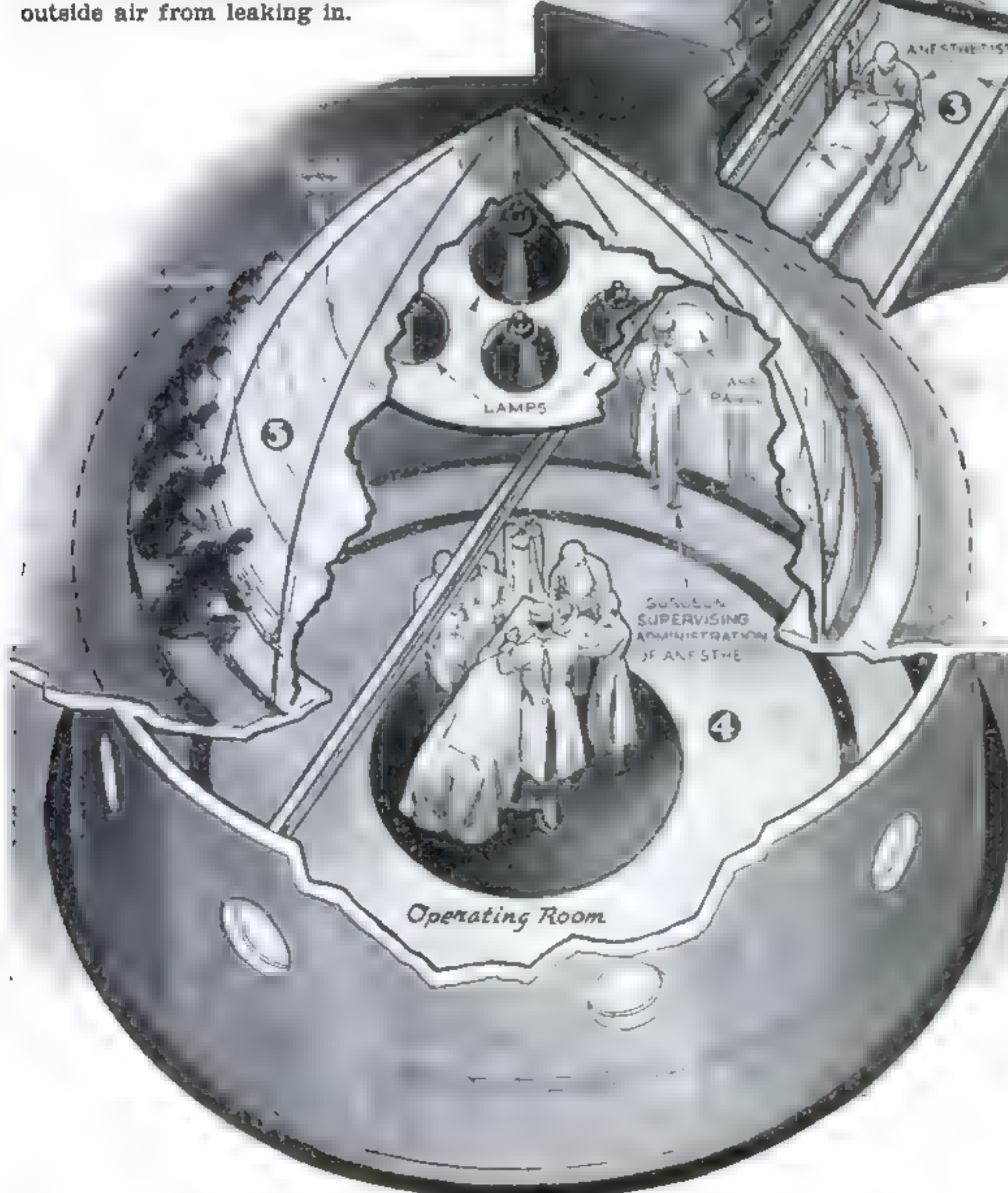
ASSEMBLY-LINE METHODS APPLIED TO SURGERY

HELP TO GUARD PATIENTS AGAINST INFECTION

- 1 Patient arrives in receiving room, which is not sterilized.
- 2 Transferred to overhead tramway, patient is prepared for operation in first sterilized chamber.
- 3 Still on tramway, patient receives anesthetic in second sterilized chamber.
- 4 Arriving in operating room, patient is lowered from tramway to operating table, and operation is performed in absolutely sterile surroundings.
- 5 Medical students watch operation through glass dome that excludes them from contact with air in operating room.
- 6 Conditioning and sterilizing apparatus supplies germfree air to operating room and outer chambers, maintaining slightly more than atmospheric pressure to keep outside air from leaking in.



Plan of the ultramodern "operating block" to be installed in the medical center at Lille, France



**B**Y ADAPTING the assembly-line methods of a factory, an ultramodern "operating block" designed by a leading French professor of medicine will provide hospital patients with surgical treatment in surroundings as nearly germ-free as human ingenuity can devise. An overhead tramway built into the new structural unit conveys the patient through a series of interconnecting rooms where he successively undergoes initial preparations, receives the anesthetic, and finally arrives at the operating table. From the moment he enters the first of the outer chambers, which resemble the air locks of a gas-raid shelter, he is exposed only to sterilized and conditioned air admitted through special ducts. Air pressure throughout the operating block is maintained slightly above the normal atmospheric pressure, so that no contaminating air from the exterior can leak in. From a gallery surrounding the circular operating room, medical students may watch the surgeon at work through a glass dome. Even the operating-room lamps are placed outside the dome. The first of the new operating blocks has been placed on exhibition in Paris, and will later be installed in the medical center at the city of Lille, France.



## Pictures Show Lightning Bolt Is a Succession of Flashes

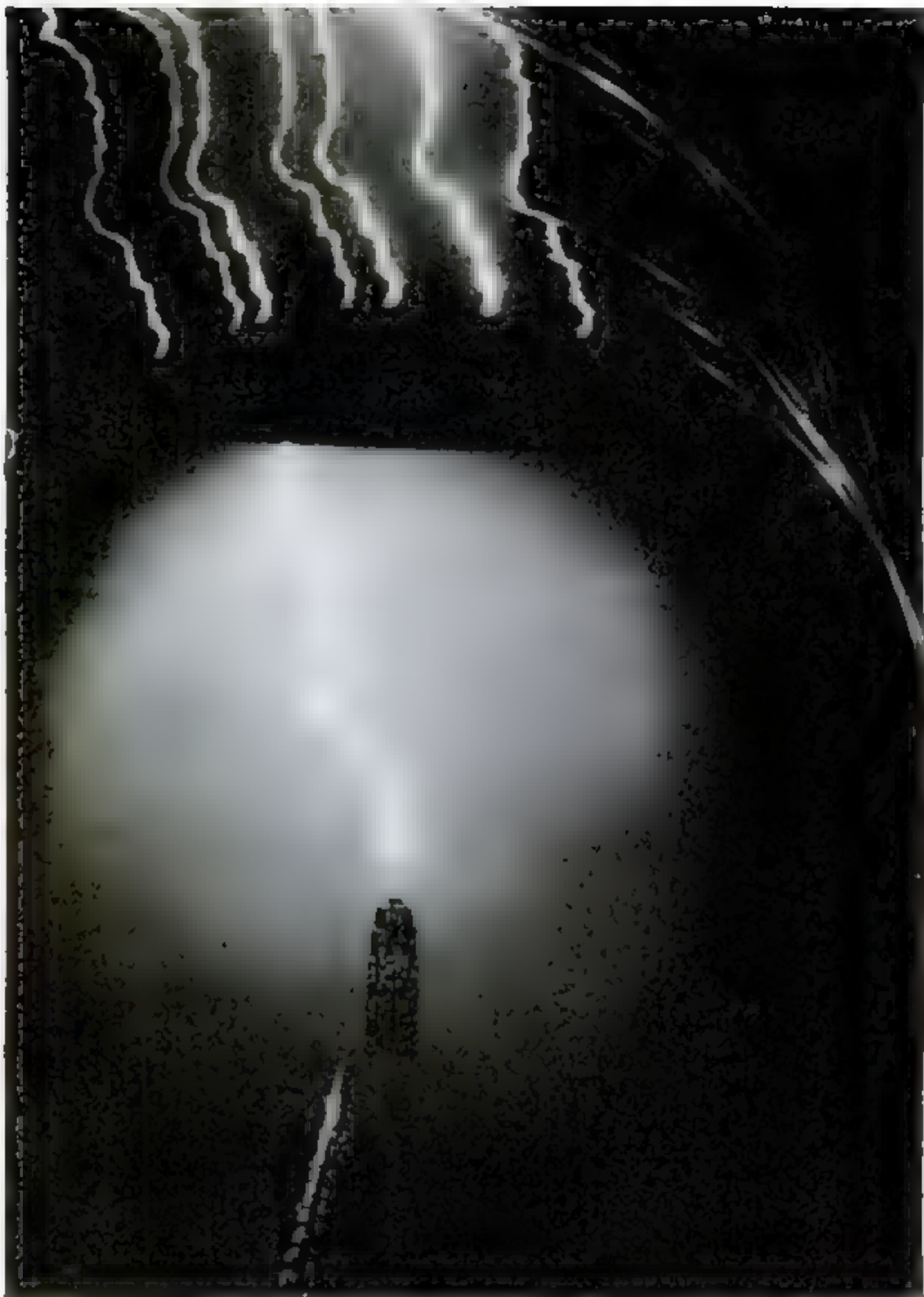
TO SOLVE the mysteries of lightning, General Electric Company engineers for three years trained a high-speed camera upon the countless bolts that harmlessly strike the Empire State Building in New York City. What appears as a single flash, as shown in the lower part of the view at right, is often a succession of flashes within a fraction of a second, as indicated by the high-speed camera's version of the same bolt at the top.

## Handy Photo-Enlarging Mask



Using the mask to control light for an enlargement

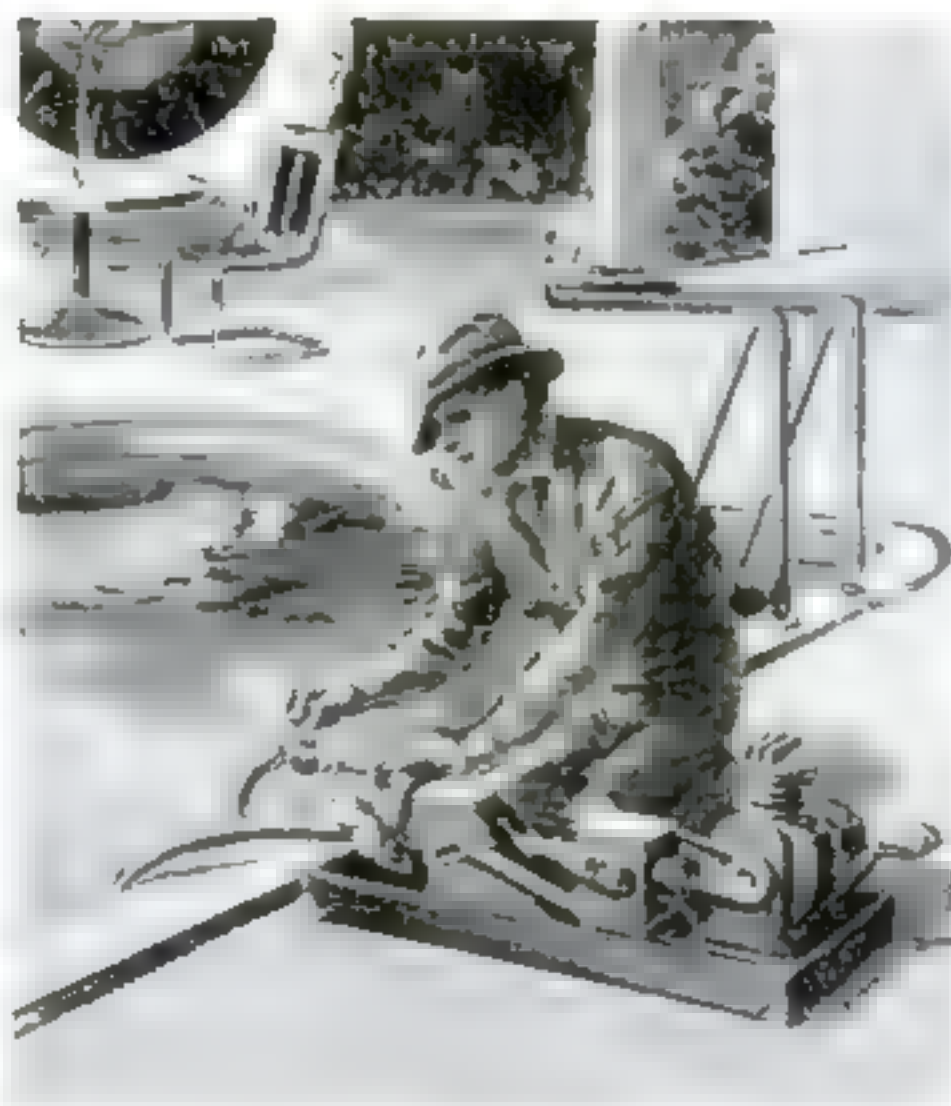
When "dodging" or overexposure of certain parts of photographic prints is required, a handy new mask replaces improvised paper cut-outs to aid photographers in making enlargements. Turning a disk on the orange-tinted screen opens an aperture of any desired shape. By holding this window over the paper during a part of the exposure, only a part of the negative is allowed to print through.



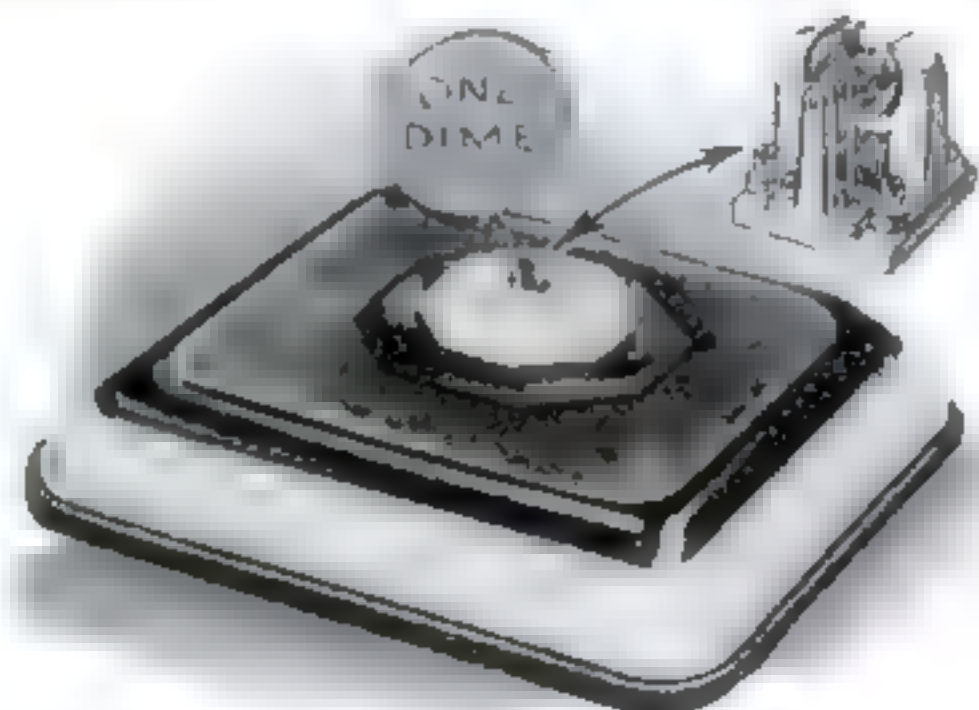
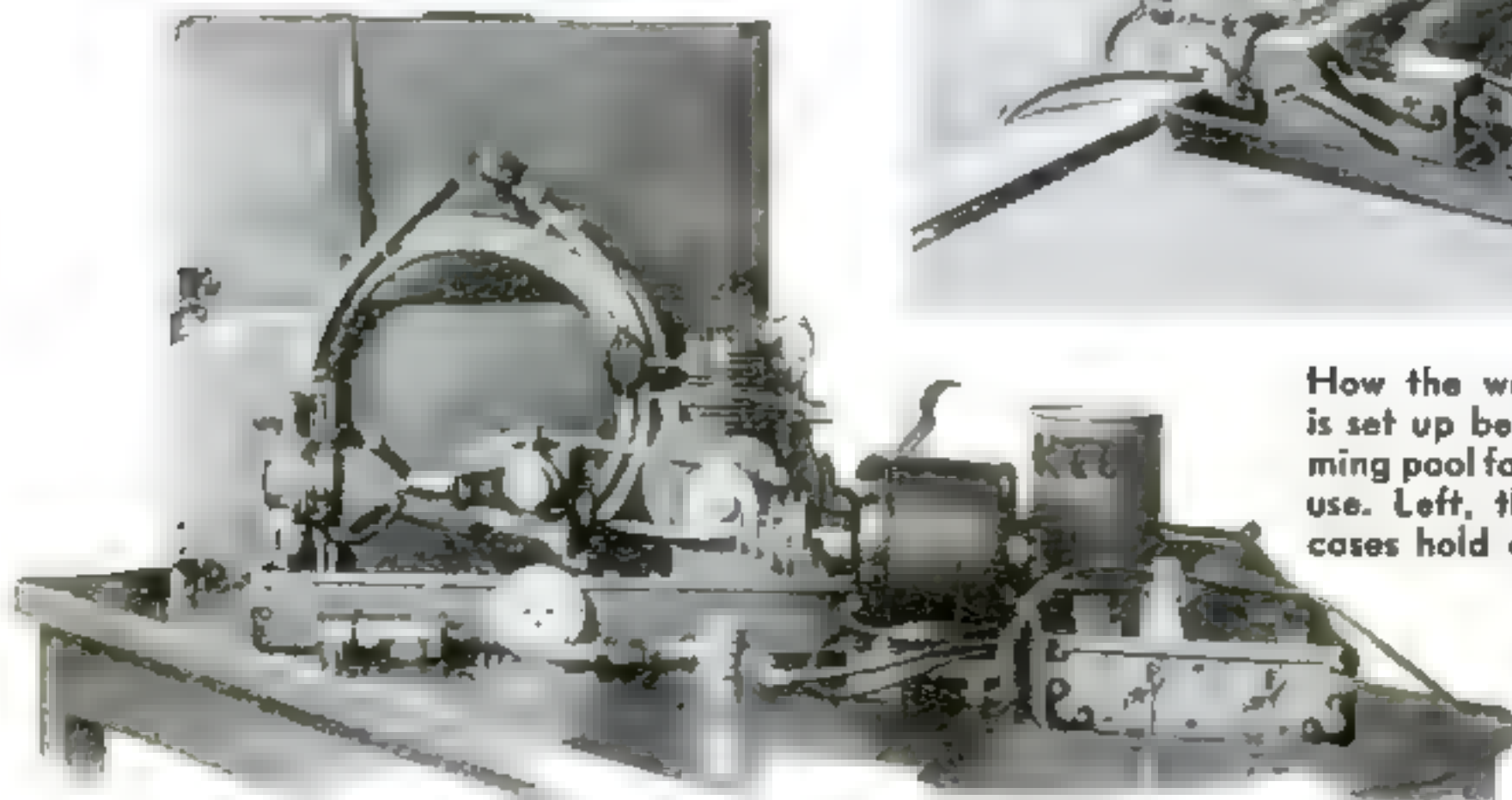
Appearing to an ordinary camera as a single flash, the same lightning bolt, caught in upper picture by a special camera, proves to consist of many flashes

## Portable Pump Disinfects Swimming Pools

DRIVEN by a light gasoline engine, a complete portable chlorinator has been designed as a stand-by or temporary replacement, in case of a breakdown in the water-disinfecting apparatus used at swimming pools and elsewhere. Compact enough to be packed in two suitcases, it may be lifted into the back of a car and transported in a jiffy to a place where it is needed. A small gasoline engine included in the outfit drives a pump that feeds the chlorine or other disinfectant into the water.



How the water purifier is set up beside a swimming pool for emergency use. Left, the two suitcases hold all the parts



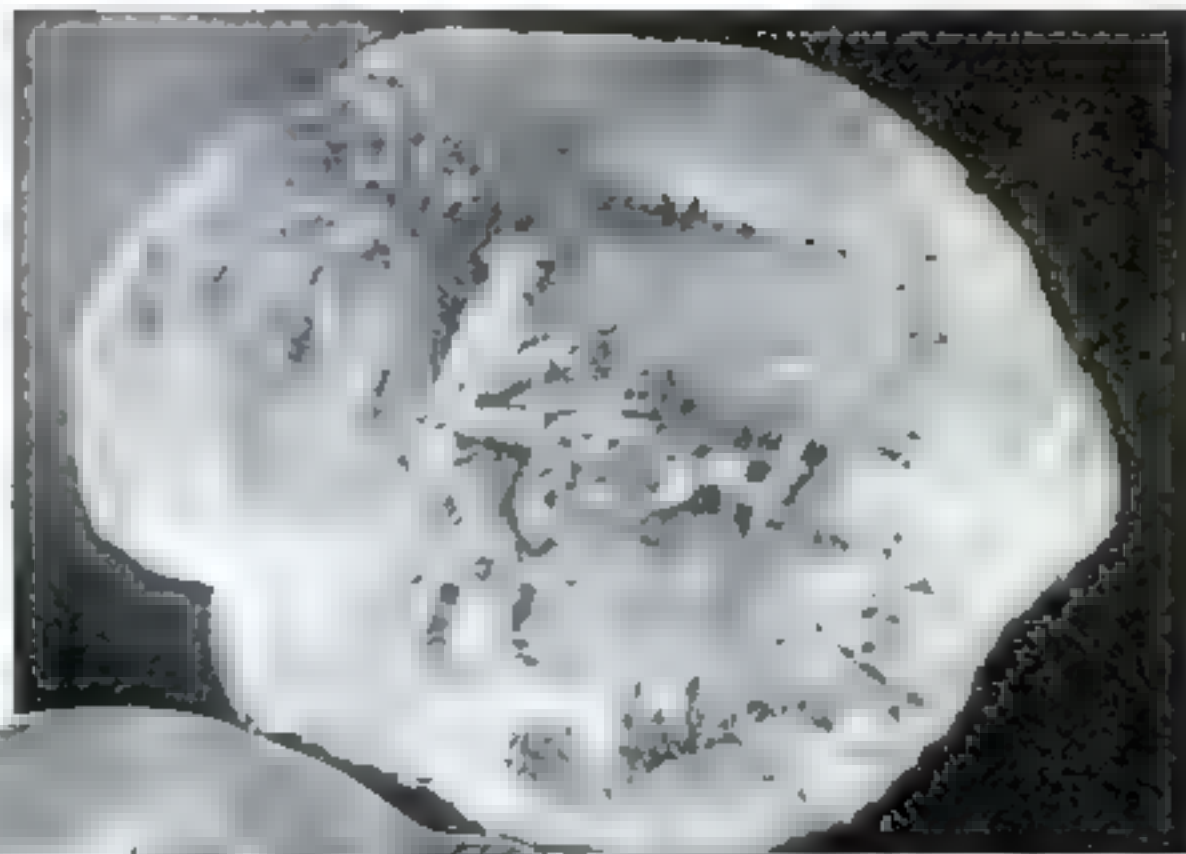
## Tiny Electric Motor Is Dwarfed by a Dime

SO SMALL that a powerful magnifying glass is needed to see it running, an electric motor no larger than the head of a safety match has just been completed by Merl Bassett, of Kelso, Wash. Dwarfed by a dime, the miniature masterpiece is shown above in the jeweler's ring box that serves it as a case, while a greatly enlarged drawing illustrates its design. The tiny single-phase motor runs on sixty-cycle alternating current at three tenths of a volt, supplied by a transformer connected to the house wiring. After being started by a twirl with a toothpick, the rotor spins under its own power at a speed of 3,600 revolutions a minute.



# Artist Engraves Pictures on Fungus as Novel Hobby

Designs are cut with a small jackknife blade



At the left are seen two remarkable hunting scenes engraved on fungus, by William H. Foster, of Andover, Mass. Striking effects are produced in contrasting shades of light and dark. In the picture below, Foster is seen collecting fungus for carving

**E**NGRAVING on large fungus plants of the kind commonly found on forest trees is the unusual hobby devised by William H. Foster, Andover, Mass., artist. Delicately cutting the soft surface of his novel medium with the sharp point of a jackknife, he obtains striking effects in contrasting shades of light and dark, as in the remarkable hunting scenes reproduced here. Some of his finished works of art are hung flat on the wall like pictures,

while others are mounted on blocks of field stone for mantel display. The unusual carvings are said to retain their freshness indefinitely. Whenever he needs a fresh supply of material, a trip through the woods with a chisel provides it.



## Postage Stamps in Lockets Are Jewelry Fad

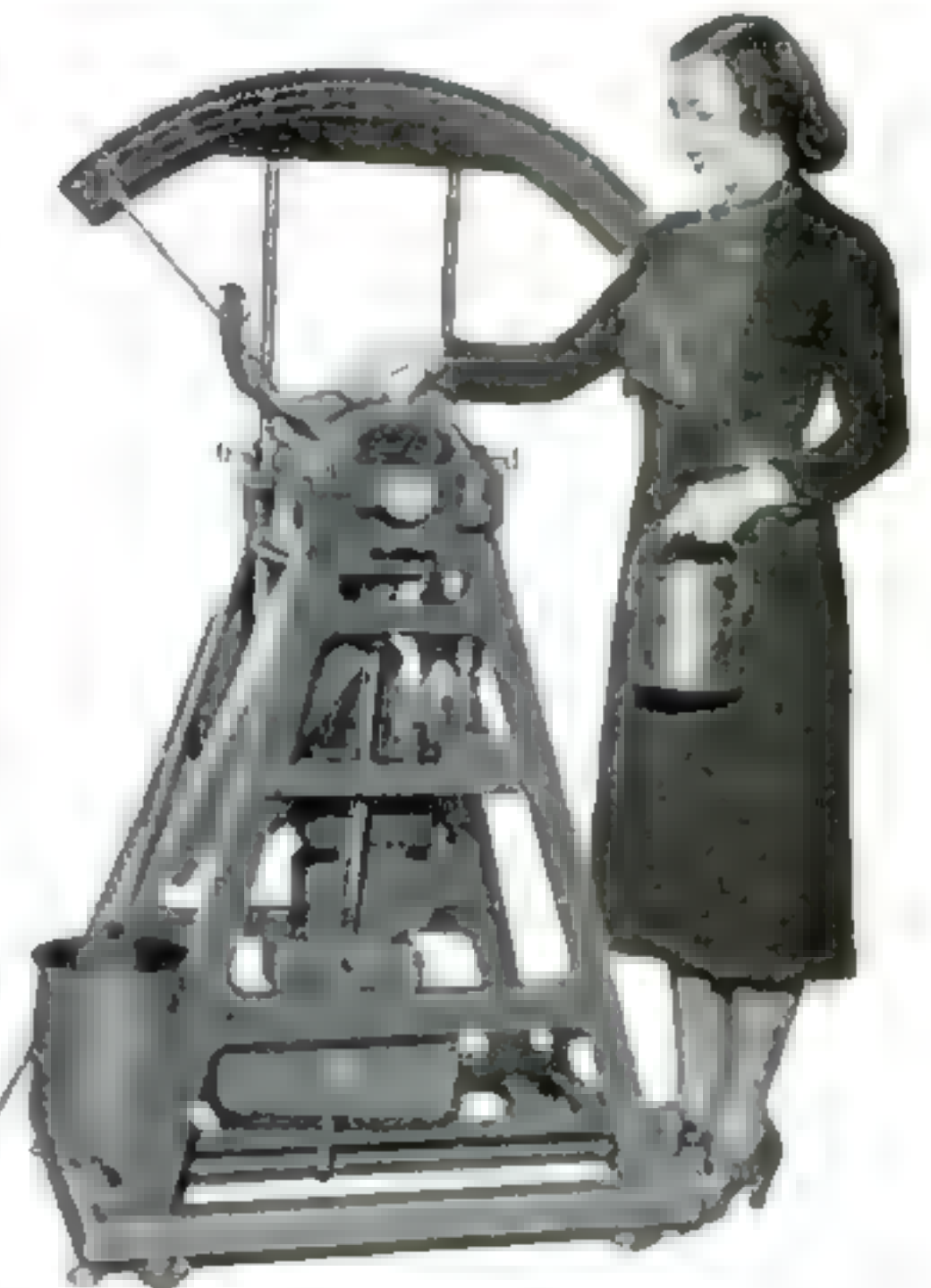
**P**OSTAGE stamps, placed in lockets, are the latest in ornaments for jewelry. A film actress introduced the fad with a bracelet of stamps from foreign fan letters, and it may also find favor among stamp collectors as a way of showing off rarities.



Ann Miller, film actress, with a bracelet of postage stamps

## Tester Shows If Peas Are Tender

**H**ow tender are peas? To find out, the odd machine illustrated at the right has been designed for canners. Peas for the test are placed in a hopper, and the force required to shear through them is indicated by the travel of a moving pointer across an illuminated scale at the top, the amount of the movement indicating the freshness.

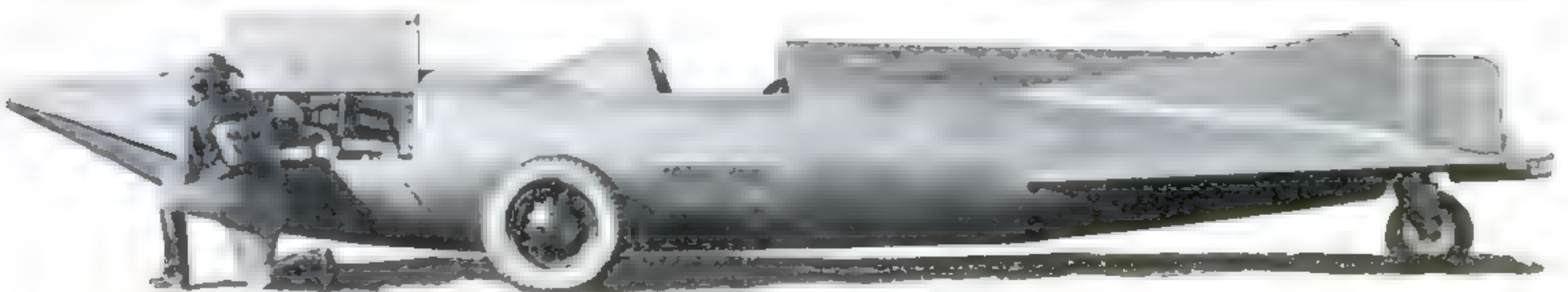


How peas are put in the hopper of the machine

## High-Speed Armored Car Looks Like a Plane

**R**ESEMBLING an airplane without wings, even to an air rudder at the rear, a high-speed armored car designed by a World War veteran would offer a small target to enemy gunners as it raced forward in a headlong attack, spouting machine-gun bullets from its tapered

nose. Bulletproof sheathing would protect the pilot and the tires of the three-wheeled "land plane," of which the inventor, William Clark, of Enid, Okla., has just completed the full-size model of the formidable land weapon illustrated below.



Full-size model of the "land plane" invented by William Clark, of Enid, Okla., for use in machine-gun attacks. The gun is in the nose





Motor-driven atomizer in use to cover bathers' skin with a special milk spray

## Milk Spray Aids Sun Tan

BATHERS at Willow Lake, near Glendale, Calif., have adopted mass-production methods to speed up the process of acquiring coveted coats of sun tan. They employ a motor-driven atomizer to apply a newly developed milk spray, which is said to protect the skin from unaccustomed exposure to the sun's rays and to help prevent burning and peeling.

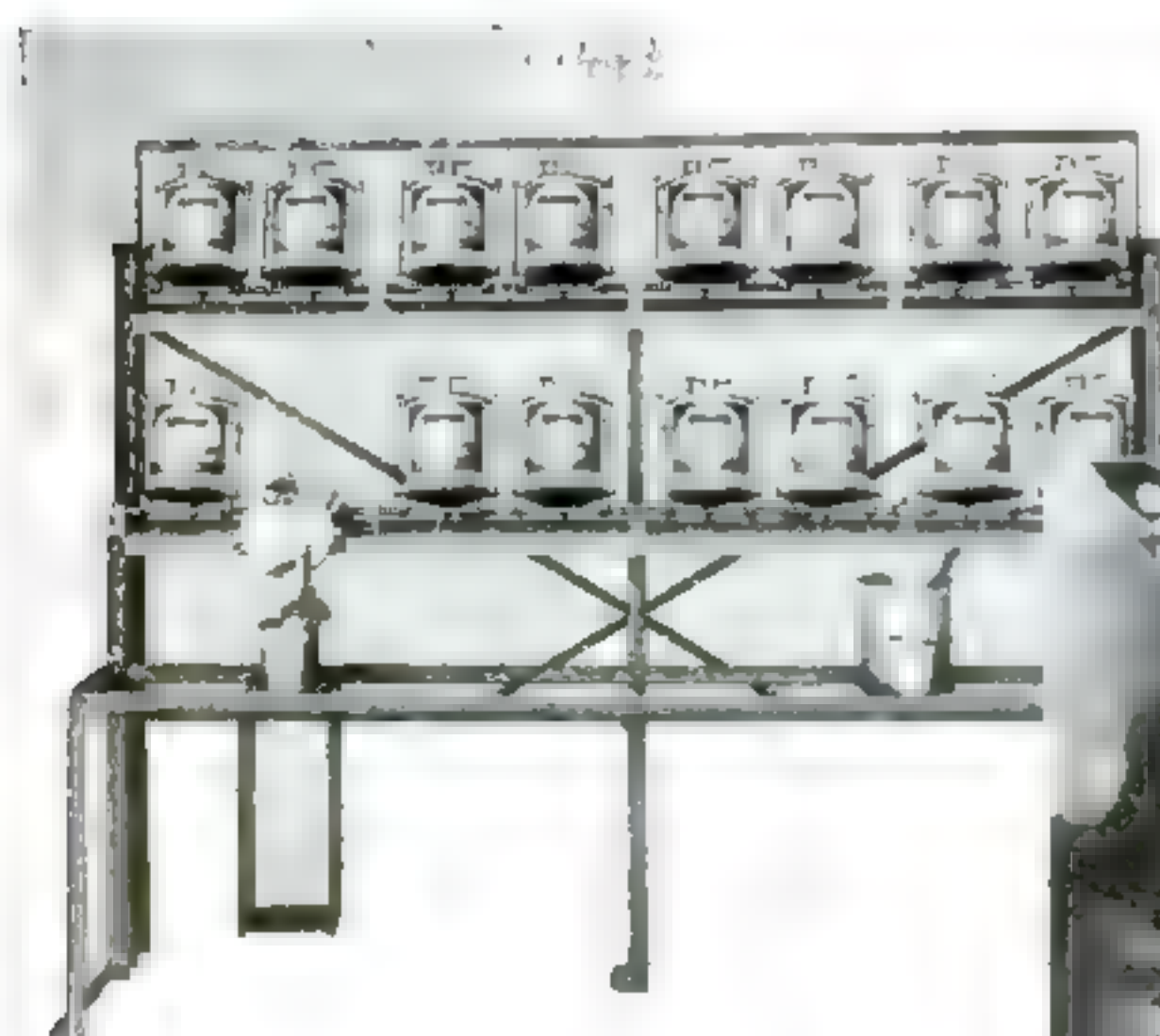
## Buttons Tune Low-Cost Car Radio

PUSH-BUTTON tuning, the modern safety feature that enables car drivers to adjust their radios without taking their eyes from the road, has now been built into an inexpensive, easily installed set. Pushing any one of five buttons on an instrument-board panel instantaneously tunes the self-contained receiver to a corresponding station.



Pressing one of the five buttons on this easily installed set tunes the desired station

## Paint-Mixing Rack Matches Car-Body Colors



Sixteen cans on the rack at left contain the ingredients for any car-body color

Below, paint being poured from a can. Note shut-off valve and agitator shaft



PAINTS used on all makes and models of American motor cars from 1933 to the present time may be matched accurately with a new color-mixing machine for garages and body-repair shops. Sixteen swivel-mounted cans, each one provided with an agitator and a shut-off valve, are so arranged that any formula called for by a master chart of directions may be quickly measured out, making it unnecessary to carry hundreds of shades in stock.



## Germs Are Destroyed by "Peanut Whistle"

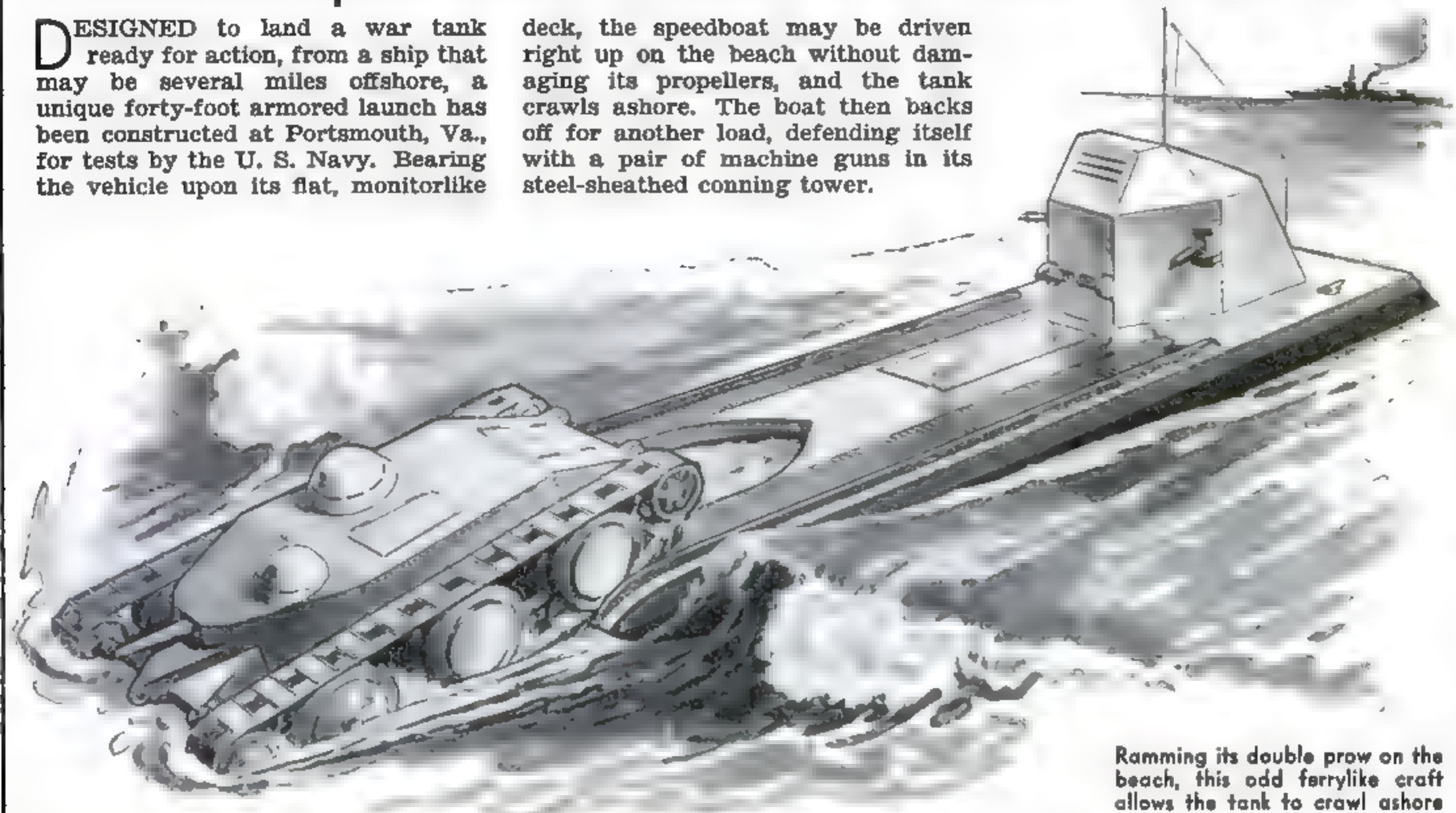
DESTROYING typhoid and other germs by exposing them to a shrill tone two octaves above piano range, produced by the "peanut-roaster" whistle shown above, is the reported accomplishment of Dr. Leslie Chambers, Philadelphia, Pa., research worker. The novel weapon may find use in the war on disease.



# Monitor Speedboat Lands War Tanks Under Fire

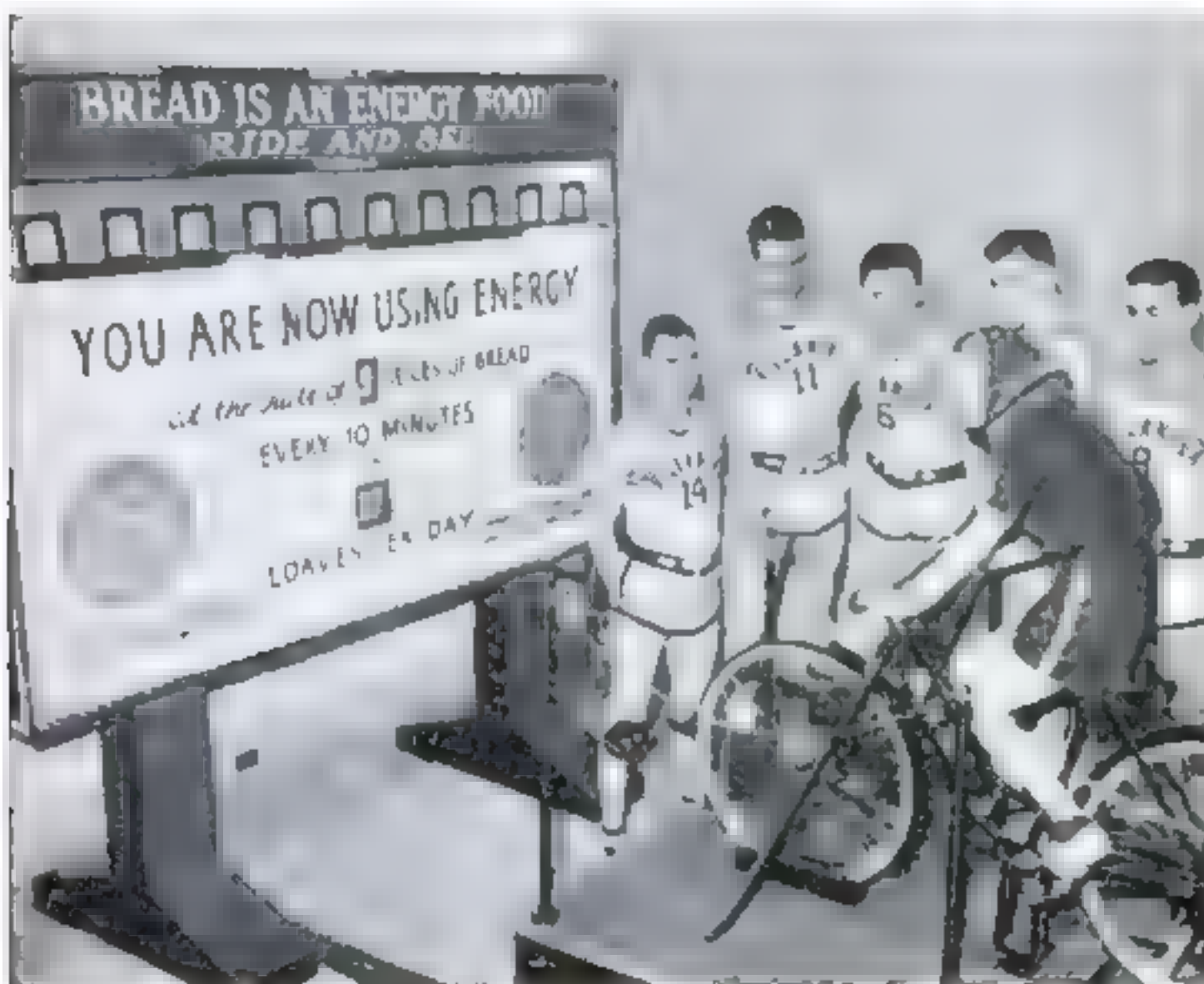
**D**ESIGNED to land a war tank ready for action, from a ship that may be several miles offshore, a unique forty-foot armored launch has been constructed at Portsmouth, Va., for tests by the U. S. Navy. Bearing the vehicle upon its flat, monitorlike

deck, the speedboat may be driven right up on the beach without damaging its propellers, and the tank crawls ashore. The boat then backs off for another load, defending itself with a pair of machine guns in its steel-sheathed conning tower.



Ramming its double prow on the beach, this odd ferrylike craft allows the tank to crawl ashore

## Meter Gauges Work in Bread-Slice Units



As the bicycle is pedaled, the board shows the food energy spent

How rapidly exercise uses up the energy in the food you eat is graphically demonstrated by a device called the "bread-o-meter" at the Franklin Institute in Philadelphia, Pa. When a visitor mounts a bicycle frame and pedals vigorously, a generator produces electricity in proportion to his effort, and figures on a board show how many slices or loaves of bread would be needed to furnish this energy.



## Flash Lamp Lights Maps for Easy Reading

**DETAILS** of maps are made clearly visible by a new flash lamp that may be set anywhere on the chart, directing light downward upon it from a bulb in an extension reflector. The handy aid is especially useful when a large number of voluminous maps must be consulted, making it unnecessary to carry them to a place where the light is more suited for examination.



Map lamp in use. An extension reflector throws light downward

## Novel Cutting Tool Aids Metal Workers

**MAKING** short work of cutting flat or corrugated sheet metal, a new tool shown above aids in repairing automobile bodies, installing warm-air furnace systems, and turning out signs and stencils. When its sharp, hook-shaped cutting point is held against the metal and the implement is tapped with a hammer, it makes a clean slit along any straight or curved line called for by the work in hand.



# POPULAR SCIENCE

## Question Bee

How well acquainted are you with the language and the facts of science? You'll enjoy testing yourself this entertaining way. There is one correct answer for each of the twenty-five

numbered questions below. See if you can find it, keeping a list of the corresponding letters. Then compare your list with the correct one on page 119 and add up the points for your score



- 1 Whales are (a) reptiles (b) fish (c) mammals (d) amphibians.
- 2 Radio sets use (a) Venturi tubes (b) audion tubes (c) Eustachian tubes (d) inner tubes (e) capillary tubes.
- 3 Knowing the length of two sides of a right triangle, you can compute the length of the third side by means of (a) the 5-5-3 ratio (b) the law of torts (c) the Pythagorean theorem (d) Foster's rule of eleven (e) the Einstein theory.
- 4 To cut off the ends of wooden strips at a uniform slant, you should use (a) a countersink (b) an angle iron (c) a rabbet plane (d) a miter box (e) a cold chisel.
- 5 Seeds of the sort called "Mexican jumping beans" bounce about because of (a) a musclelike mechanism for scattering them widely (b) their responsiveness to atmospheric electricity (c) the spasmodic twitching of a small parasitic caterpillar in the seed.
- 6 After development is complete, you should put photographic film in (a) boiling water (b) hypo (c) aqua regia (d) cotton batting (e) gamboge.
- 7 Compressed-air workers who dig vehicular tunnels are popularly called (a) ground hogs (b) road hogs (c) sandhogs (d) Bessemer pigs.
- 8 The weather man calls rain and snow (a) hypothecation (b) precipitation (c) decantation (d) insolation.

- 9 Instead of lenses, some of the largest astronomical telescopes use (a) sky filters (b) Nicol prisms (c) planetary gears (d) concave mirrors.
- 10 Ohm's law (a) entitles you to be considered innocent until you are proved guilty (b) shows the effect of pressure upon the volume of a gas (c) explains the workings of economic supply and demand (d) sums up in a simple formula the relationship between electric voltage, current, and resistance.
- 11 Mariners reckon their longitude from (a) the Rome-Berlin axis (b) the Greenwich meridian (c) the equator (d) the line of syzygies.
- 12 You can use linoleum for making (a) bromide prints (b) fingerprints (c) block prints (d) blueprints.
- 13 The Arctic lemming is noted for (a) the fact that it is six months long (b) suicidal migrations in which hordes of the rodents march into the sea and perish (c) its marvelous arches and streamers of colored light in the sky.
- 14 What enables some insects to walk on water is (a) aqueous tension (b) surface tension (c) nervous tension.
- 15 Automatic sprinkler systems use (a) fire plugs (b) spark plugs (c) fusible plugs.
- 16 The banging noise you hear in steam-radiator pipes is called (a) water hammer (b) foot pound (c) carbon knock.

17 Resolving power means (a) strength of will (b) clearness as well as magnification in what you see through a microscope or telescope (c) a number like the 7 in  $10^7$ .

18 C. G. S. stands for (a) an alloy of copper, gold, and silver (b) the centimeter-gram-second system of units (c) "cum grano salis."

19 The boundary between the cold air of high latitudes and the warmer air of lower latitudes is called a (a) rising front (b) united front (c) polar front (d) popular front.

20 A dashpot (a) keeps glue ready for use (b) requires a player to have jacks or better to open (c) acts as a shock absorber in machinery.








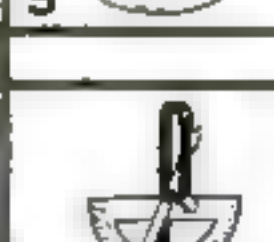

21 The man who invented dynamite is more generally remembered for (a) designing the Diesel motor (b) building the Panama Canal (c) founding the Nobel prizes (d) writing "Alice in Wonderland."

22 Mutineers from the British ship *Bounty* founded a colony of great interest to anthropologists upon (a) Long Island (b) Easter Island (c) Pitcairn Island (d) the Isle of Capri.

23 A small hand tool bearing several notches and terminating in a sharp-edged steel wheel is used to (a) open soft-boiled eggs (b) remove paint from woodwork (c) strip insulation from electric wires (d) cut glass.

24 The moon has no (a) water (b) gravity (c) sunlight (d) mountains.

25 Storage batteries should be replenished from time to time with (a) ammonia water (b) distilled water (c) Javelle water (d) carbonated water.

Here are some of the tools you might expect to find in a physics laboratory. Try to label the pictures correctly from the list below. Answers are on page 119

radiometer	wet cell	tuning fork
galvanometer	Wimshurst machine	
dipping needle	optical bench	
electroscope	spectroscope	



# Un-Natural History

By  
GUS MAGER



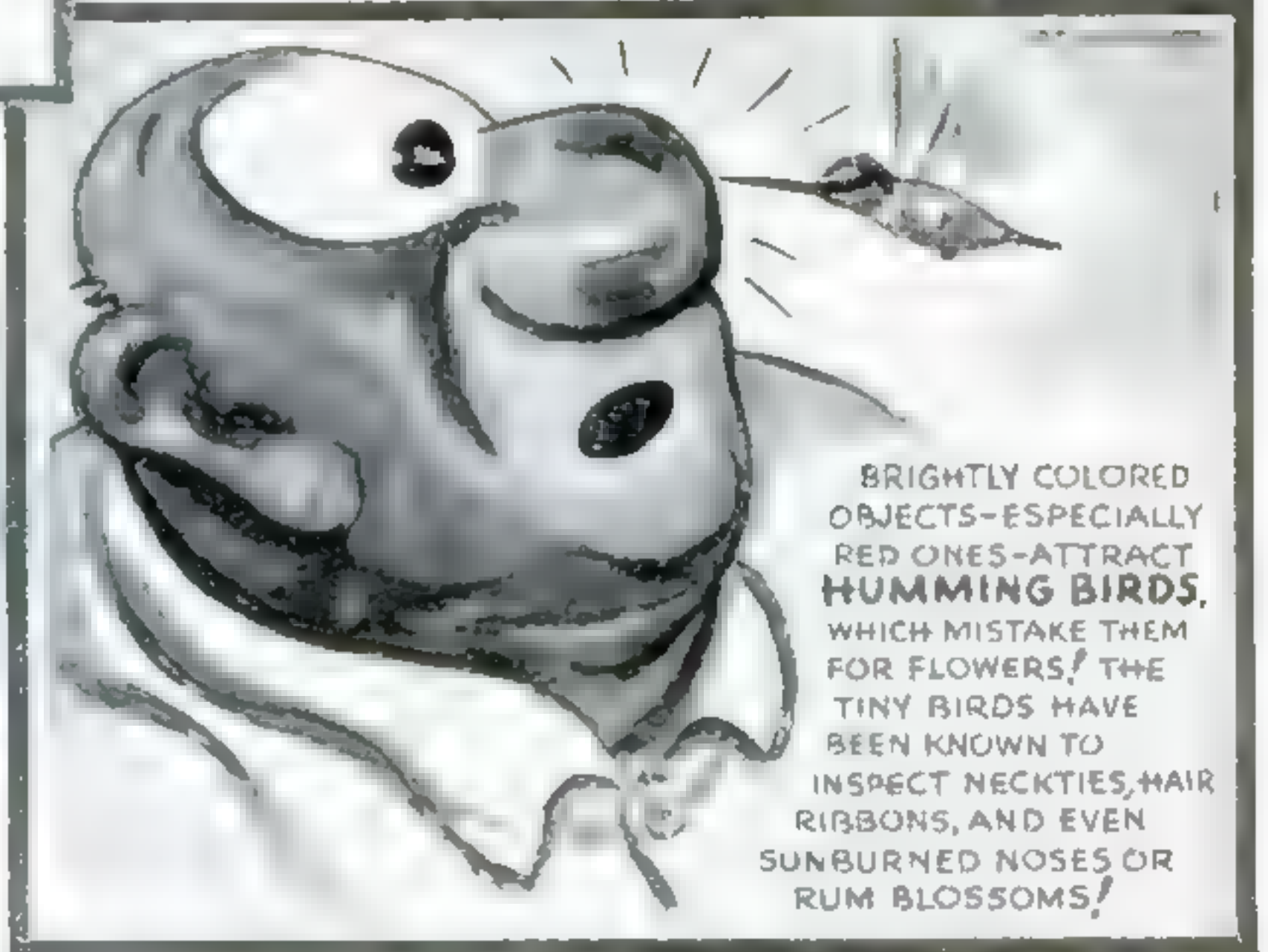
THE GROWTHS ON A GIRAFFE'S HEAD ARE NOT LIKE THE HORNS OF OTHER ANIMALS, BUT BONE COVERED WITH HAIRY SKIN! MOST GIRAFFES HAVE TWO OF THEM, PLUS A POTATOLIKE BUMP ON THE FOREHEAD, BUT A SPECIMEN RECENTLY DISCOVERED IN UGANDA HAS TWO EXTRA HORNLIKE GROWTHS BEHIND ITS EARS!



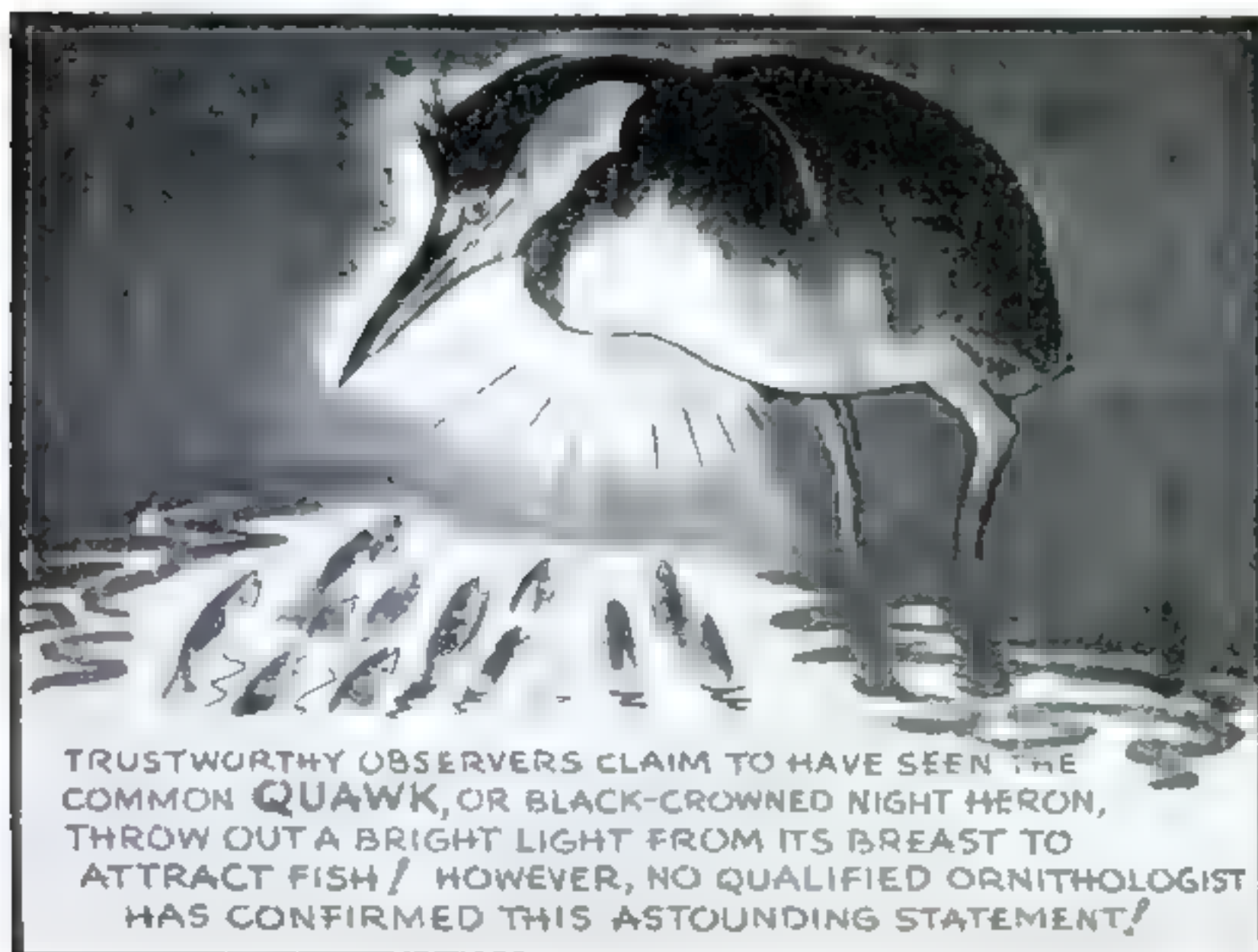
WILD HERDS OF GIRAFFES IN CENTRAL AFRICA WERE NEARLY EXTERMINATED BY THE WORLD WAR! BECAUSE THE GALLOPING ANIMALS KEPT WRECKING MILITARY TELEGRAPH LINES, SOLDIERS OF THE BRITISH AND GERMAN COLONIAL ARMIES WERE ORDERED TO SHOOT THEM ON SIGHT! SINCE THE WAR, STRICT PROTECTION HAS RESTORED THEIR NUMBERS!



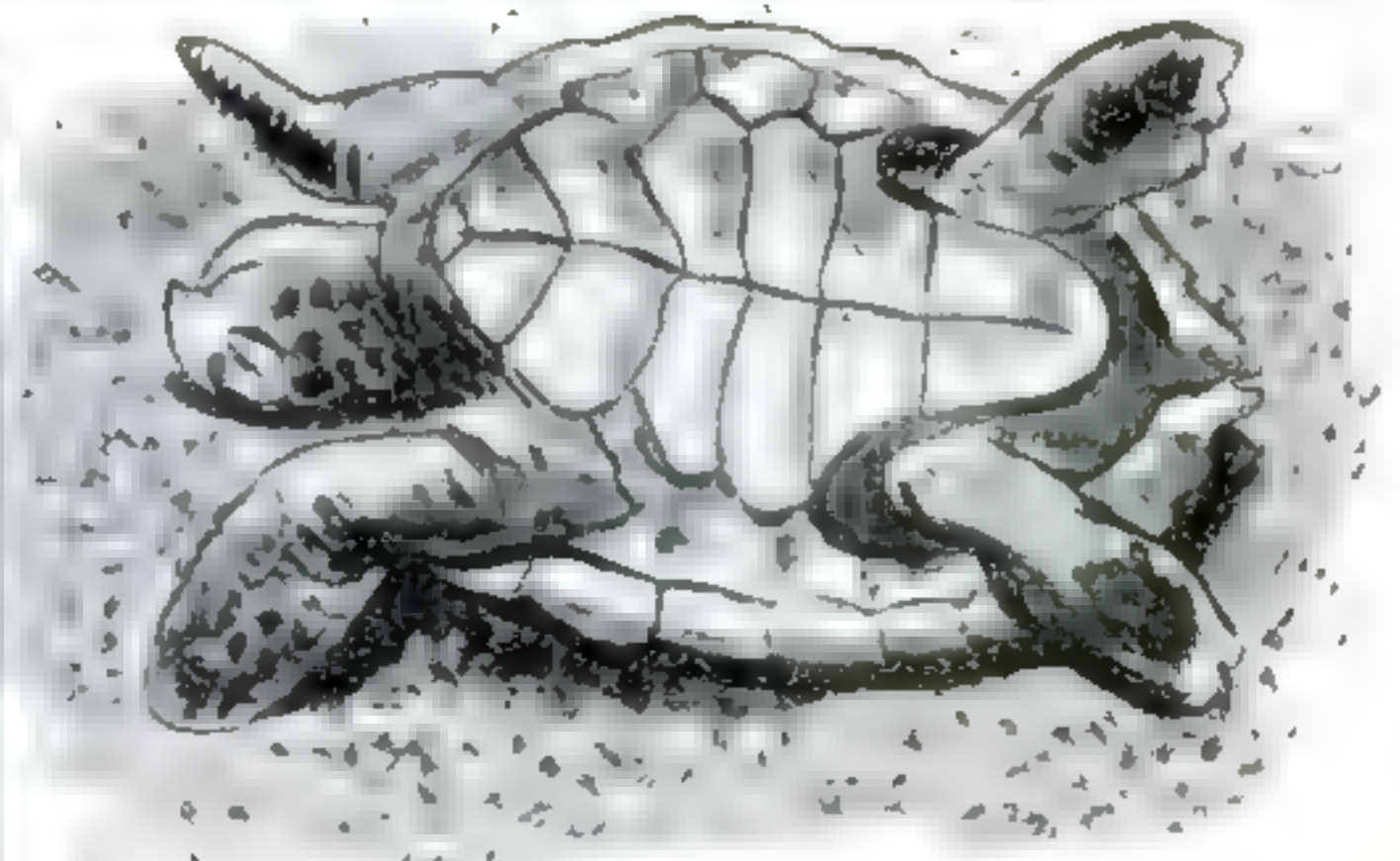
ONE SPECIES OF PARASITIC FLY HITCH-HIKES ON BIRDS UNTIL IT GETS A CHANCE TO TRANSFER TO A DEER OR OTHER MAMMAL! THEN IT BITES OFF OR CASTS ITS WINGS, AND LIVES HAPPILY EVER AFTER!



BRIGHTLY COLORED OBJECTS-ESPECIALLY RED ONES-ATTRACT HUMMING BIRDS, WHICH MISTAKE THEM FOR FLOWERS! THE TINY BIRDS HAVE BEEN KNOWN TO INSPECT NECKTIES, HAIR RIBBONS, AND EVEN SUNBURNED NOSES OR RUM BLOSSOMS!



TRUSTWORTHY OBSERVERS CLAIM TO HAVE SEEN THE COMMON QUAWK, OR BLACK-CROWNED NIGHT HERON, THROW OUT A BRIGHT LIGHT FROM ITS BREAST TO ATTRACT FISH! HOWEVER, NO QUALIFIED ORNITHOLOGIST HAS CONFIRMED THIS ASTOUNDING STATEMENT!



IF YOU EVER CATCH A SEA TURTLE OUT OF WATER AND WANT TO KEEP HIM ALIVE, TURN HIM OVER ON HIS BACK! THE UNDER SHELL IS SO SOFT THAT THE TURTLE'S GREAT WEIGHT COMPRESSES THE INTERNAL ORGANS AND SOON CAUSES DEATH! UNDER WATER, OF COURSE, IT'S DIFFERENT!



# New Inventions



**TRIPLE TOWEL HOLDER.** Spaced properly on the kitchen or bathroom wall, twin brackets have slots that grip towels or cloths for fast drying



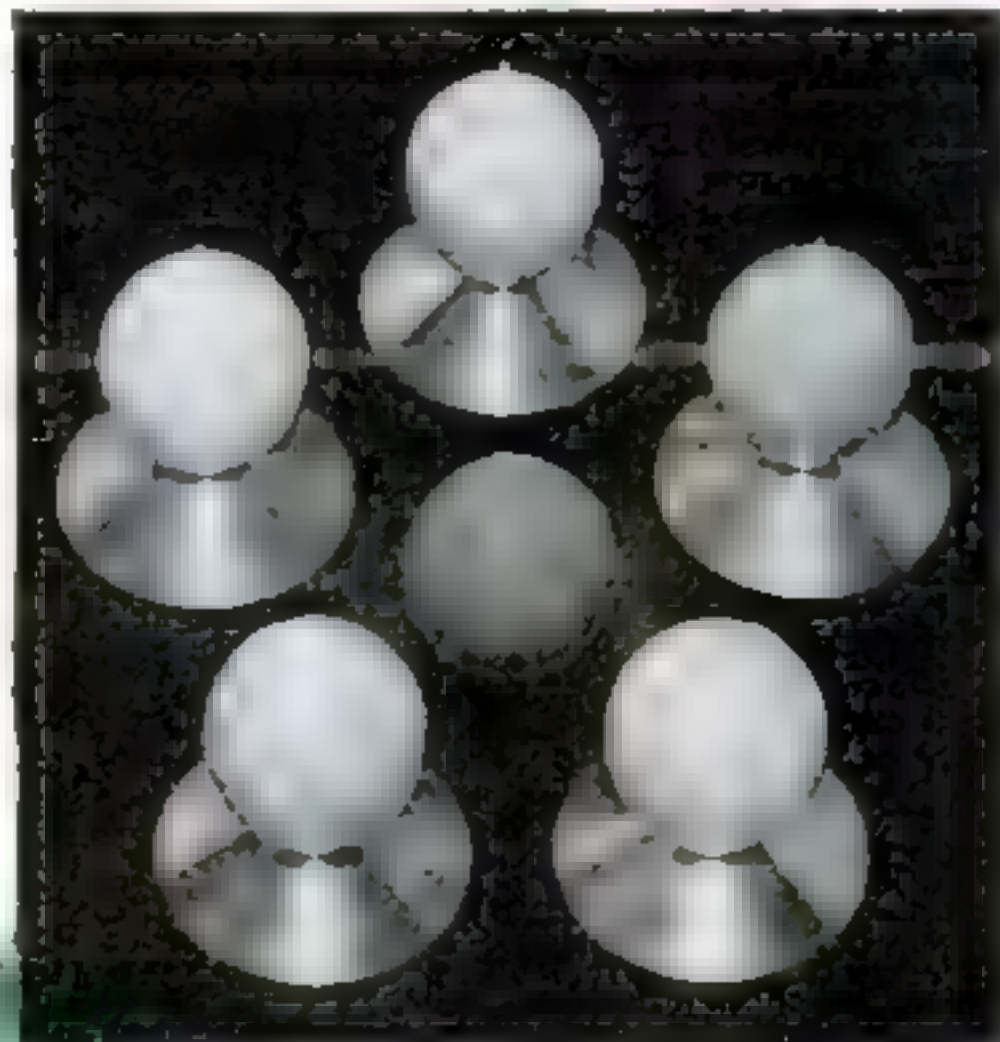
## HANDY TABLE GRILL

For broiling meats or fish, baking, and frying without fat, this versatile electric grill can be used in the kitchen or on the dinner table. The tray makes an attractive serving platter, and the lid will serve as a hot plate, as seen below

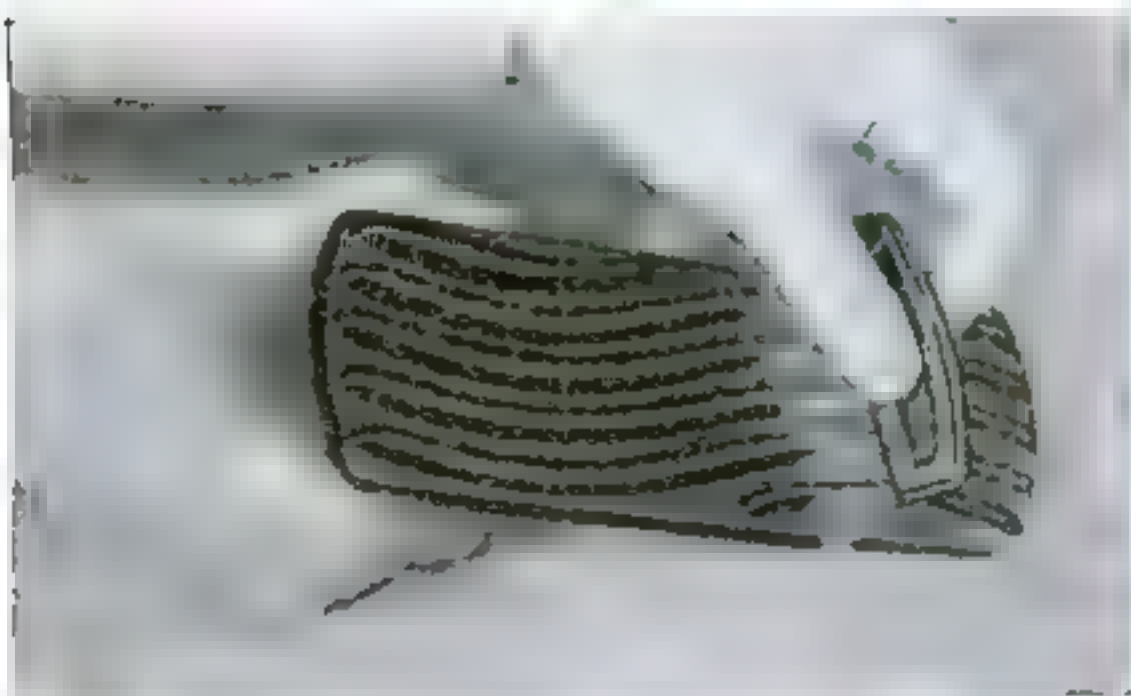


## MODERN KITCHEN SCALES

Molded of plastic material in tear-drop shape, the scales shown below measure pounds and ounces separately on dials seen through windows. Weighs up to twenty-five pounds



**BIG-APPLE CANDLES.** Suggested by the current dance craze, novelty candles are molded and colored to represent apples. Each candle has an attractive base of metal



## NOVEL UPHOLSTERY CLEANER

Dust loosened by wavy ribs on this hard-rubber cleaning tool as it is brushed over upholstery is attracted by the static electricity generated by friction. Collecting in the hollows, the dust is removed with a brush as shown in the picture above



**FOLDING CLOTHES RACK.** A man's suit is held neatly on this rack, which folds for storage as at left. The upper tray is for pocket accessories, while the lower one accommodates shoes



# Lighten Home Chores

**SELF-SHARPENING MINCER.** Straddling a plate with its rubber-toed feet, the device at the right is designed for chopping, grating, or grinding raw foods. The moving blade sharpens itself



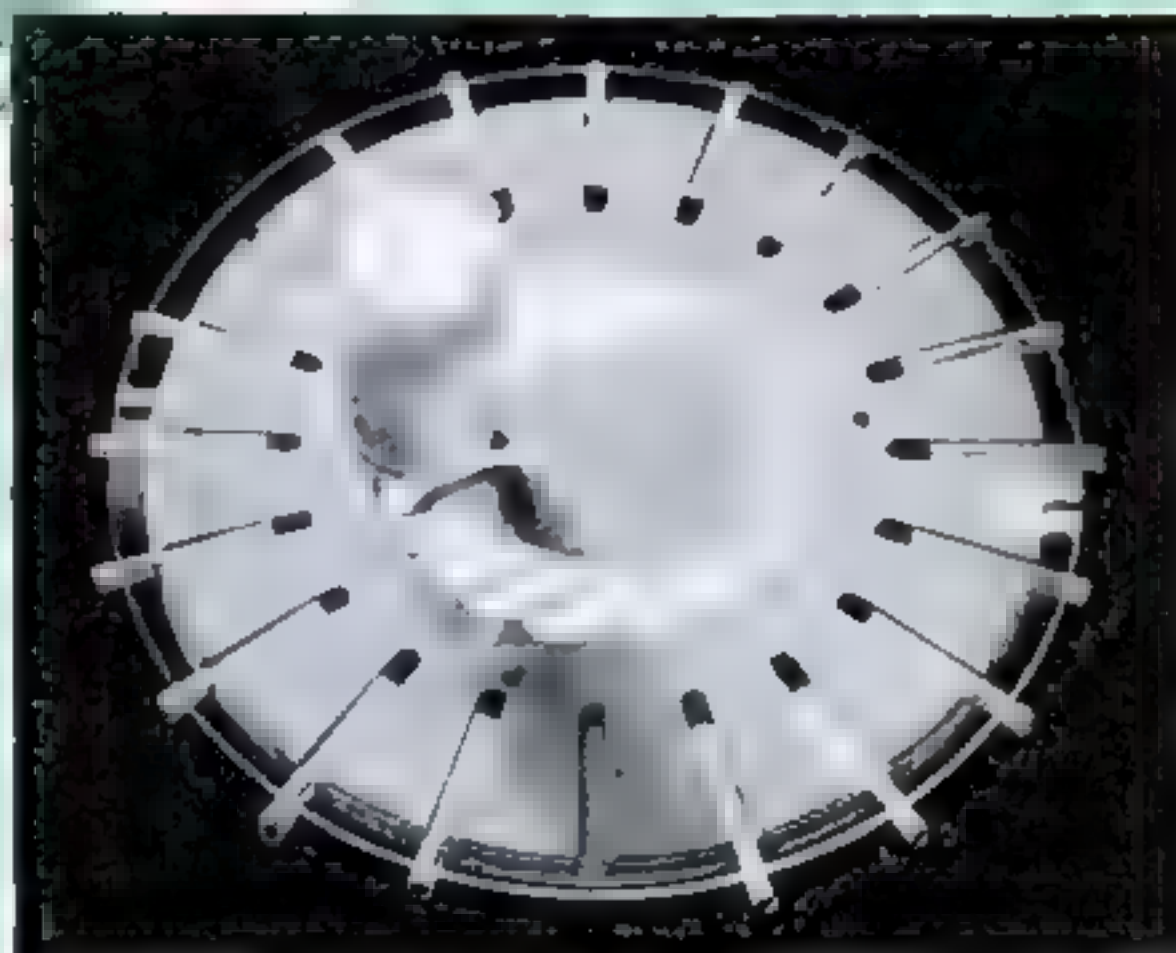
**NOVEL EGG COOKER.** An ingenious timing system is employed in the electric egg cooker below. For each minute the eggs are to cook, a teaspoonful of water is put in. At the end of that time, current is shut off automatically, and a warning bell rings



**SLICES MEAT IN THE CAN.** Canned meat or fish is cut into easily removed slices by the spiral blade of this knife. Inserted in the open can, the tool is revolved for cutting



**DRIPLESS PITCHER.** By pressing a lever above the handle of a new pitcher, the user can cut off that last drop of milk or sirup



**BEVERAGE TRAY.** Slots in the rim of this novel serving tray hold twenty cigarettes for guests. The glass top of the tray is removable from the base for serving drinks or refreshments

## MITTENS HAVE SCOURING PADS

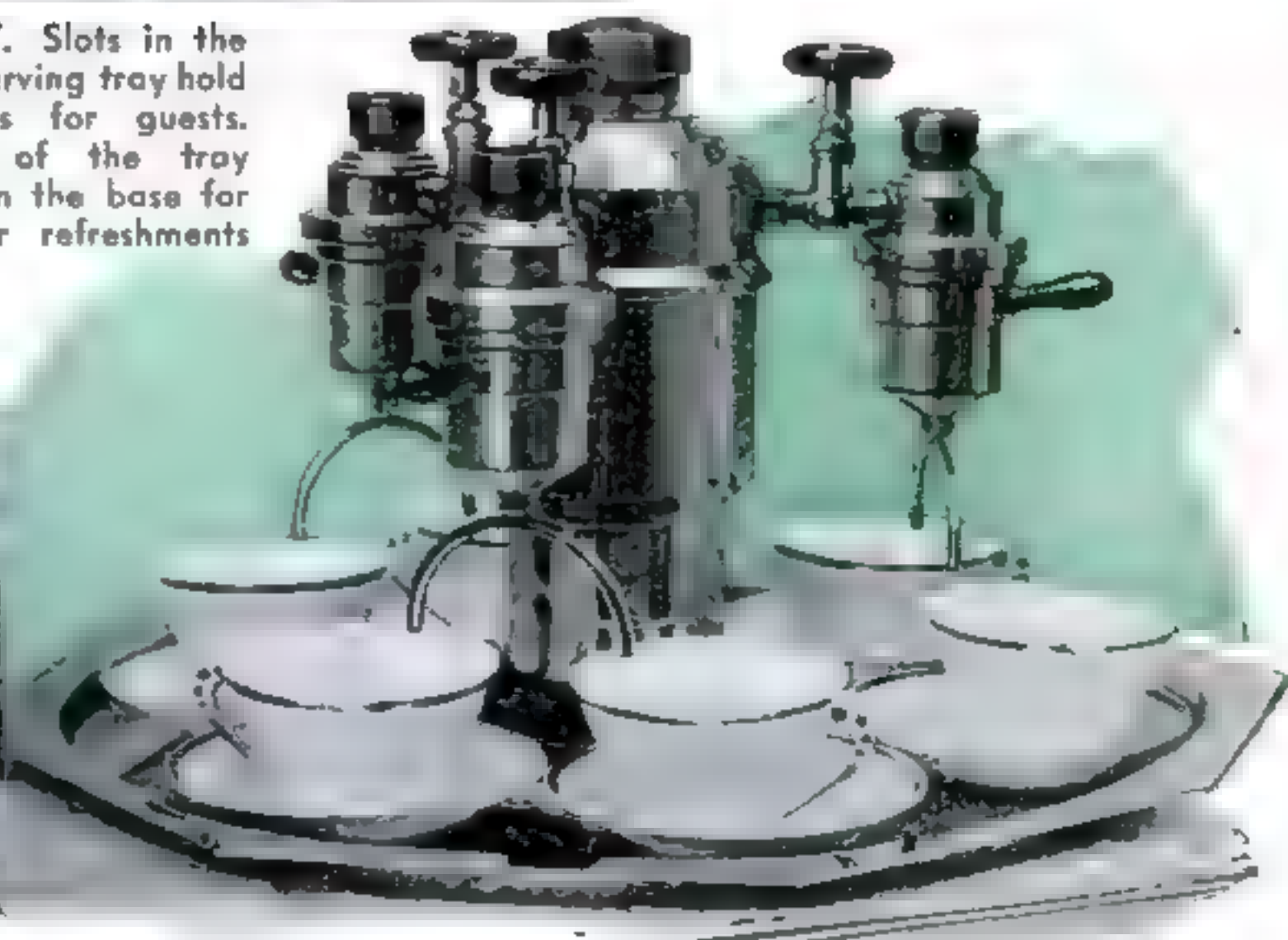
Abrasive pads vulcanized into the finger and thumb sections of the rubber mittens at the right are useful in washing dishes, scouring pots and pans, and other tasks about the home and garden



**PORTABLE IRONER.** Operated on a table, the electric ironer above starts and stops by elbow pressure on a lever, leaving hands free. It will even iron a bed sheet

## COFFEE PERCOLATOR

Coffee is made in various degrees of strength, to suit individual taste, in the novel family percolator seen below. It has a capacity of six cups





# Gus Settles a Family Quarrel

By  
MARTIN BUNN

IT WAS a warm, sunny May afternoon. In the little office of the Model Garage Joe Clark was busy over his ledgers. But outside, his chair tilted back against the wall beside the open office window, Gus Wilson sat idly smoking his pipe. His peaked black mechanic's cap lay on the ground beside him, and he was lazily enjoying the tickling sensation on his scalp caused by the languid breeze blowing gently through his close-cropped gray hair.

"What I'd like to do," he said through the window to his partner, "is go up to the lake and go fishing. And what I ought to do is get right back there in the shop and finish up that transmission job on the Kellys' old bus. Hey, Joe, you old fossil—don't you ever feel like doing anything except just working?"

A rubber stamp thudded dully on an inking pad and banged more sharply on the desk as Joe stamped "paid" on a bill, and his pen scratched as he wrote his initials and the date carefully under the stamp. "I'd a darned sight rather work here in comfort than sit in a boat all day with a million bugs biting me, the way you got me to do last summer," he answered at last. "But if you want to go fishing so bad, why the heck don't you take tomorrow off, and go? Things are sort of slow right now. I'll be around, of course, and Harry'll be able to take care of 'most any rush job that's likely to come in."

Gus laughed. "Bass season doesn't open for two weeks," he said. "I was just talking. But d'you know, Joe, you hit on just what's the matter with the garage business nowadays, when you said that Harry could take care of any job that's likely to come in. Sure he could—Harry or any other competent motor mechanic. That's the trouble—one repair job is getting to be too much like all the rest of them to suit me. What I'd like would be a good, old-fashioned brain-teaser—something that

would get my old bean to working full speed again. Yes, sir, that's what I need to wake me up!"

Joe grunted disdainfully. He knew the sort of job that his partner was wishing for—the sort of job that he could fool around with for the better part of a half day locating the trouble—and then charge the customer fifty cents because it took him only a couple of minutes to remedy it!

A shiny new roadster came rolling smoothly along the highway, slowed down, and then turned in at the garage. As Gus put down his pipe, pulled on his cap, and started for the gas pump, he saw that the car was driven by a middle-aged, pugnacious-looking little man who had a youngish and very stout woman sitting beside him. To his surprise, the driver didn't pull in at the gas pump, but drove right up to the office door, where he stopped and cut off his engine.

"This the Model Garage?" he demanded. "You Gus Wilson?"

"Right both times," Gus assured

him, grinning as he approached the car.

"My name's Snodgrass," snapped the little man. He gave a sideways jerk of his head toward his companion. "That's Mrs. Snodgrass." The stout woman smiled constrainedly. Gus noticed that her face was flushed and that the light of recent battle lingered in her blue eyes. "They tell me that you're a real trouble-shooter," went on the little man, "a regular J. Edgar Hoover when it comes to tracking down grief in a motor."

"Oh, I wouldn't say that," Gus began modestly. "But sometimes I'm able to—"

"All right!" interrupted Snodgrass. "Well, see if you can find out what's the matter with this car. The devil's in it—or in my wife. Open up the hood." Gus opened it. The little man turned the ignition switch and stepped on the starter. The engine purred as creamily as a radio crooner's voice. "What about that?" demanded the little man.

"What about what?" Gus asked. "There's nothing wrong with that engine—never heard one run more smoothly."

Snodgrass switched off the engine and hopped out of the car. "Now you do it!" he ordered his wife. Her face redder than ever, she moved over into the driver's seat, switched on the engine, and stepped on the starter. Nothing happened. She tried again and again, an expression of mingled amazement and disgust on her face.

Snodgrass was dancing with rage as he pointed an accusing forefinger at her. "It's her fault!" he yelled. "Just what I've been telling her. It always will run for me, but it never will run for her. She does something wrong. But what the devil is it?"

Gus opened (*Continued on page 126*)

Snodgrass was dancing with rage. "It's her fault!" he yelled. "It always will run for me, but it never will run for her. She does something wrong. But what is it?"







Broken bits of flagstone are laid in mortar around a tapered sheet-metal form 30 in. high

# Garden Lighthouse

## FLASHES ON AND OFF AT NIGHT

**OR**NAMENTAL by day and doubly effective at night, this miniature lighthouse is an attractive garden feature.

The materials: A metal lantern of appropriate shape, without socket; three red girders from a toy construction set, or something else suitable for a guard rail; one small flame-shape electric bulb; one all-rubber pigtail socket; broken flagstones and Portland cement; one sheet of galvanized iron, 30 in. long by 20 in. at one end and 24 in. at the other; sufficient lead-covered cable to reach underground to the house lighting circuit, and a flasher plug.

The base is made from a flagstone about 2 in. thick, shaped with a cold chisel to form a rough circle about 20 in. in diameter. With a star drill, make a  $\frac{1}{2}$ -in. hole in the center.

The inner form is a sheet-metal column (open at both ends), 30 in. long with a diameter of 6 in. at the top and  $7\frac{1}{2}$  in. at the base. Overlap

the edges about  $\frac{3}{4}$  in. and rivet. Cut rectangular openings 4 by  $4\frac{1}{2}$  in. on opposite sides for windows. In the base, cut an arched opening about 5 in. high

and green panes may be installed. Pull the lead cable through the hole in the base and connect the wires to the socket.—ALAN BURTON.

for the lighthouse doorway.

Flagstones about 1 in. thick are broken into small pieces about  $1\frac{1}{2}$  in. wide and from 2 to 3 in. long. The mortar is three parts sharp sand and one part Portland cement, mixed rather dry. Set the form on the center of the base and, starting at one side of the doorway, lay a thin layer of cement right around the form. Set the stones in this and proceed in the same way to the top of the form. Small iron bars (nails with heads sawed off) may be set into the windows. Raking the cement from the cracks improves the appearance.

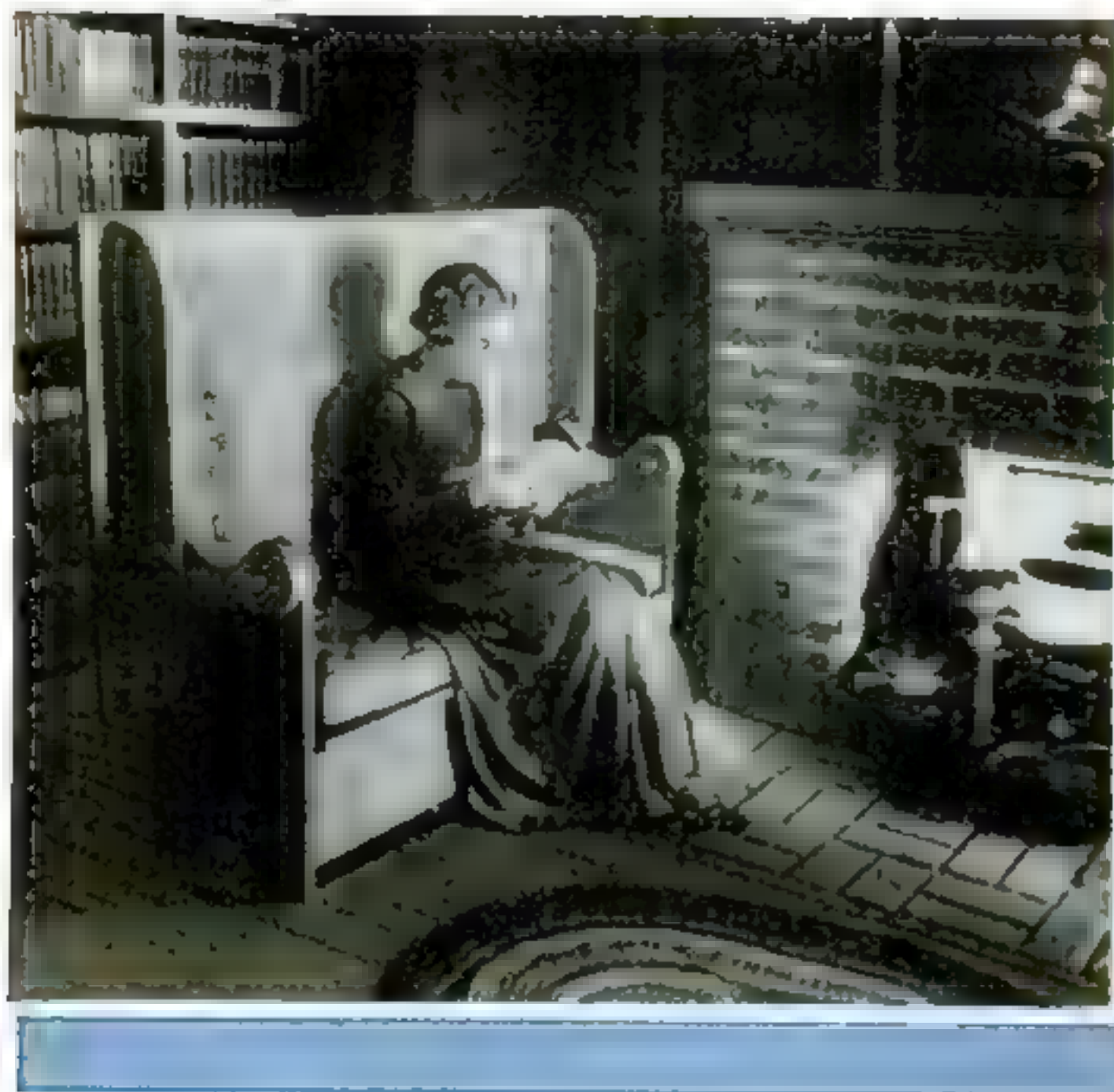
The top is cast from cement in a tin lid  $1\frac{1}{2}$  in. thick and 12 in. in diameter, and has a  $\frac{1}{2}$ -in. hole in the center. A piece of  $\frac{7}{8}$ -in. thick pine is set into the top to hold the socket, and its shape and size will depend on the opening in the bottom of the lantern. The socket should fit snugly into a hole in the center of the pine block. A flasher plug is screwed into the socket, and then the bulb is inserted.

The lantern may be picked up in most electrical shops where fixtures are made and assembled, and preferably it should be one in which red





## Colonial Charm and Utility Combined in an



Tip back the top, and the table is transformed into a comfortable high-backed Colonial settle. The seat lifts to reveal a storage box

### EASILY BUILT

# Hutch Table

By W. W. WHEATLY

The table forms an attractive piece for living room, game room, or sun porch



**T**HIS hutch table recommends itself to the modern mode of living because of its versatility. Few single pieces of furniture have so many uses, or look as well in their varied rôles. When it is used as a bench, the wing cleats give it the charm of a Colonial settle; and as a table, it will seat four persons comfortably. The commodious box or hutch is a convenient place to tuck away toys, magazines, or extra linen. When a drawing table is needed, the top may be tilted at an angle.

Either hardwood or a good quality softwood such as Douglas fir is suitable. When gluing up the top, drill dowel holes  $1\frac{1}{2}$  in. from either end and space the others  $11\frac{1}{2}$  in. apart. Saw out the top wing cleats and drill the holes as shown. With the top still in the bar clamps, hold the wing cleats in place with hand screws and fasten them to the top with screws.

Run a slight bevel inside and outside the two edges of the butted joints of the end pieces to form a V. Screw the seat cleats and bottom cleats in place on the inside of the end pieces. Mark off the pattern at the top and bottom of the end pieces and saw out. Then saw the end cleats to the pattern, screw them in place on the end pieces, and bore the holes as shown through both cleats and end pieces.

Screw the bottom cleats on the inside of the front and back panels, and fasten the panels to the end pieces by screwing them up to the cleats and with screws through the end pieces into the panels. Put in the bottom boards and fasten with  $\frac{3}{4}$ -in. brads. Screw the back band (hinge strip) in place, and fasten the hinges to it and to the box cover, thus finishing the seat.

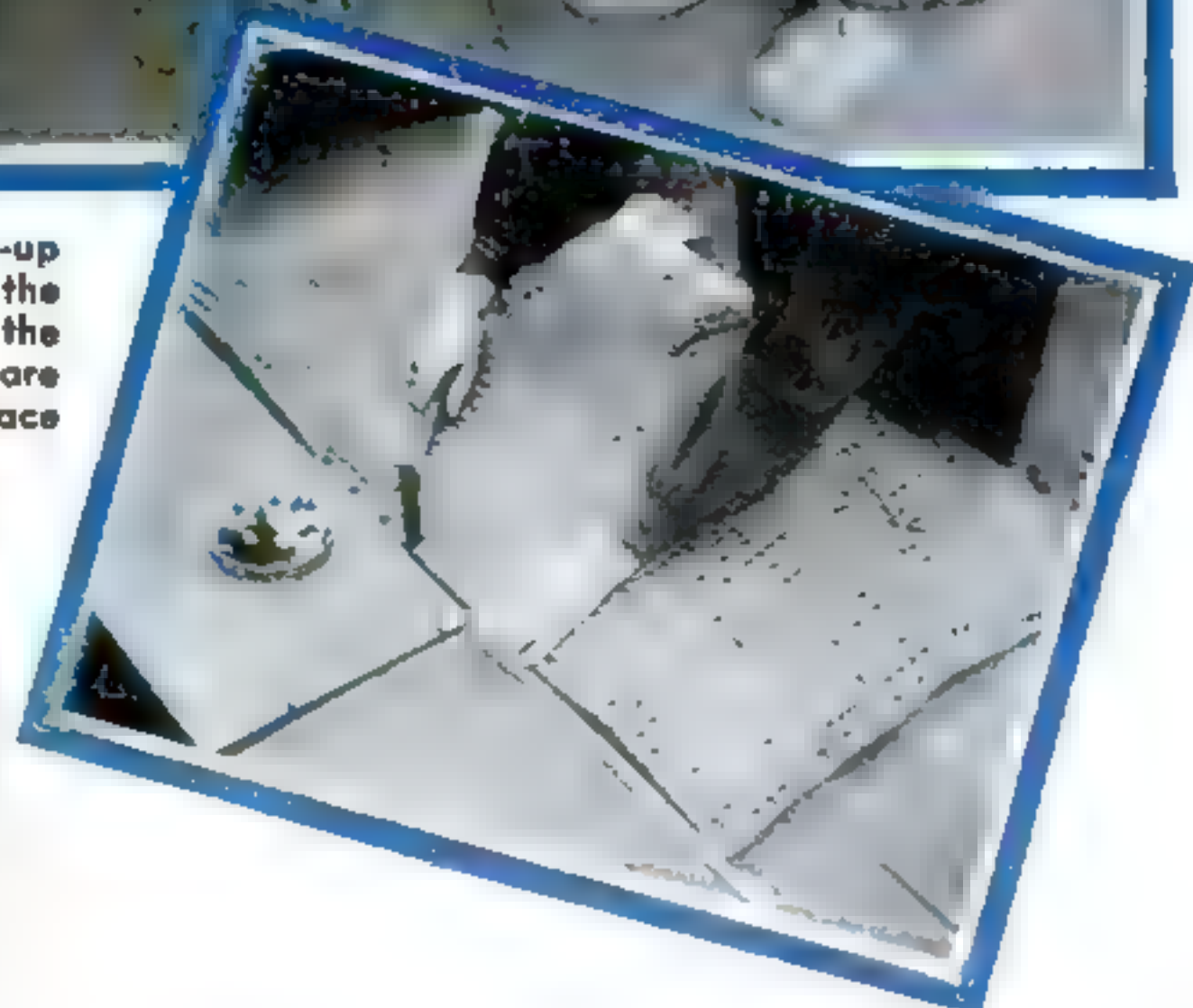
Add the final touches by applying an oil stain of suitable color and a simple rubbed-wax finish to all the woodwork, not forgetting the underside of the table top.

Making the seat cushion and back pad is a job of simple sewing. The first and most important requirement is to finish all seams on one side before beginning those on the other side.

The boxed cushion cover is made with French seams, which show on the outside like a welt. To make a French seam, cut the upholstery fabric in pieces the size specified, baste all the right faces together and stitch, but leave one end seam open for



While the glued-up top is still in the bar clamps, the wing cleats are screwed in place



The pad is attached to the seat back with fancy tacks. A tape measure and rule are used to make certain it is properly placed



## LIST OF MATERIALS

No. Pc.	Description	T.	W.	L.
4	Ends*	$\frac{3}{4}$	8	$26\frac{1}{4}$
2	End cleats*	$\frac{3}{4}$	$5\frac{1}{4}$	16
2	Seat cleats	$\frac{3}{4}$	2	$14\frac{1}{2}$
2	Bottom end cleats	$\frac{3}{4}$	1	14
2	Bottom panel cleats	$\frac{3}{4}$	1	48
2	Bottom boards	$\frac{1}{2}$	$7\frac{1}{4}$	$49\frac{1}{2}$
1	Seat back band (hinge strip)	+	3	$49\frac{1}{2}$
1	Seat (hinged box cover)	$\frac{3}{4}$	$13\frac{3}{4}$	$49\frac{1}{4}$
2	Front and back panels	$\frac{3}{4}$	$8\frac{1}{2}$	$49\frac{1}{2}$
2	Table top	1	14	60
1	Table top	1	8	60
12	Hardwood dowels for top	$\frac{3}{8}$		3
2	Top wing cleats	1	6	36
4	Hardwood dowel hinge pins*	$15/16$		$4\frac{1}{2}$

NOTE: All dimensions are given in inches and are finished sizes. For parts marked with an asterisk (\*), see detail or pattern.

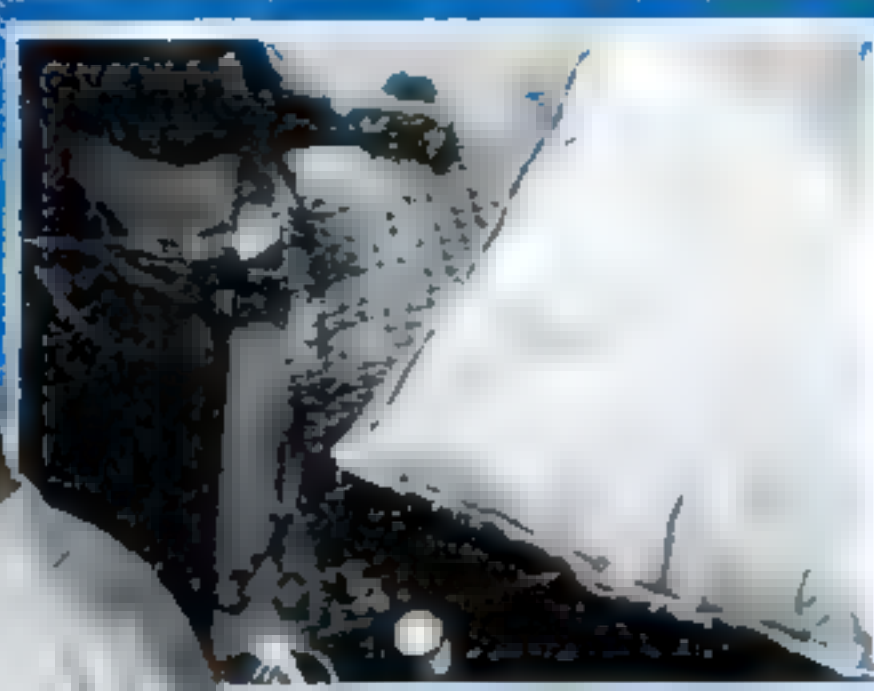
Screws: 42—2-in. No. 7 and 48—1½-in. No. 6 flathead bright wood screws. Hinges: 1 pr. 3-in. tight-pin butts with 1-in. screws. 1 box round-head upholsterer's tacks. Upholstery fabric: 2 pc. 17 by 50 in.; 2 pc. 4 by 50 in.; 2 pc. 4 by 17 in.; 1 pc. 24 by 40 in. Muslin: 1 pc. 24 by 40 in.; 1 pc. 38 by 50 in. Batting: 1 light wool "bat," 5 lb. kapok or silk floss.



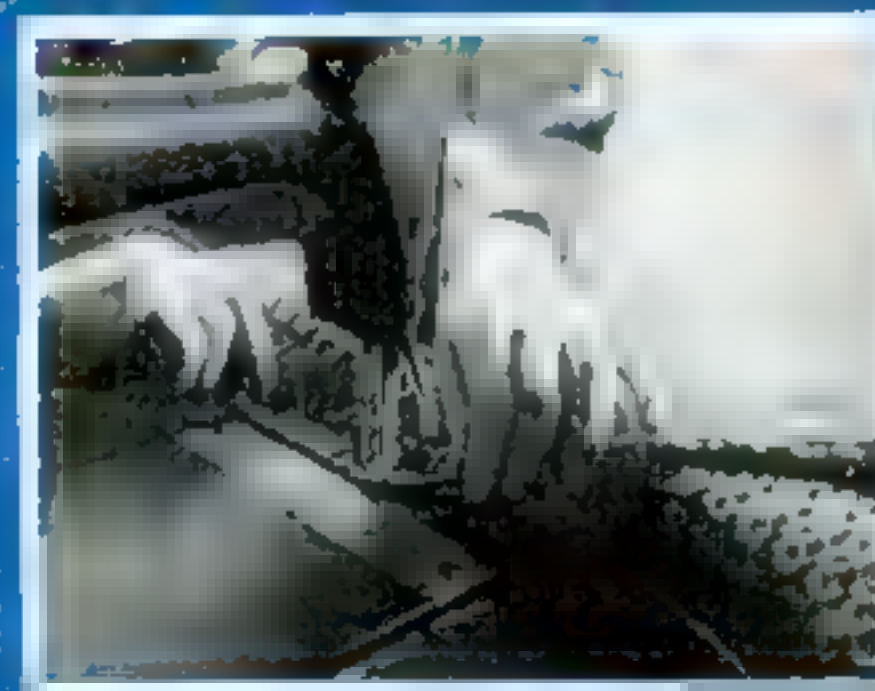
Fitting the cushion to the boxed cover by tucking in the corners and then catching the corner in place with needle and thread.



When the cover opening is closed, tape is stitched along the seams to reinforce the rather loosely woven upholstery material.



Doubled button thread is sewn through the back pad and then tied at the back.



When the upholstery fabric, the wool "bat," and the muslin for the seat pad are together, the edges are stitched by machine.

inserting the cushion. Next, press with damp cloth, turn and baste the seams on the right side, and stitch. Press again. The boxed cover is now ready for the cushion.

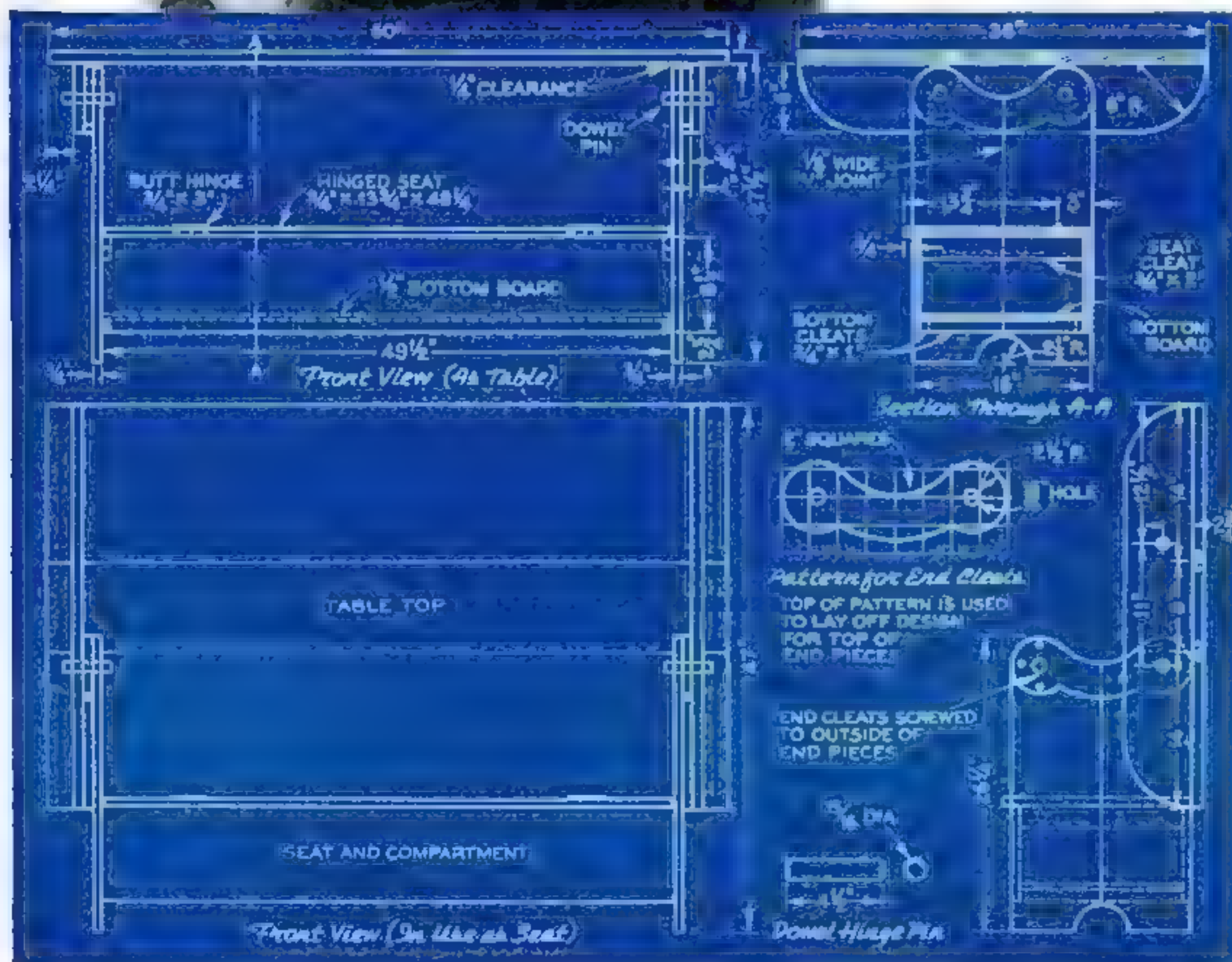
To make the cushion, sew up the length of muslin or ticking, fill with kapok or silk floss, close the opening left for stuffing, and finish the squared corners as illustrated. Insert in the cover, and finish.

For the back pad, cut (do not fold) the wool "bat" in

pieces slightly smaller than the muslin backing, place one atop the other, and baste together with long stitches, using an upholsterer's needle and heavy thread. Place the wool batting on the muslin back so that it is even all around, and carefully cover with the upholstery material. Finish as shown.

When applying this pad to the seat back, it is placed 10 in. down from the top of the seat back and at equal distances from either end. Use a tape measure for placing the tacks on 2-in. centers, and a rule for keeping the pad straight with the top of the seat back. Begin at the top center and work to either end; next tack along the bottom, being careful to keep the pad snugly against the wood. Finish by tacking along the ends.

Working drawings of the hutch table. Note that the top may be tilted whenever necessary to serve as a drafting board.





Two horses take little more space than one when not in use. Right, a board can be sawed close to the support without danger of cutting into the leg



## Sawhorses with Three Legs NEST TOGETHER COMPACTLY

THREE-LEGGED sawhorses constructed as shown above have the advantage of nesting closely together so they can be stored in a small space. In addition, sawing can be done close to the horizontal support at the end where there is only one leg without any danger of cutting into that leg. A third feature lies in the fact that the three legs will rest solidly on any surface.

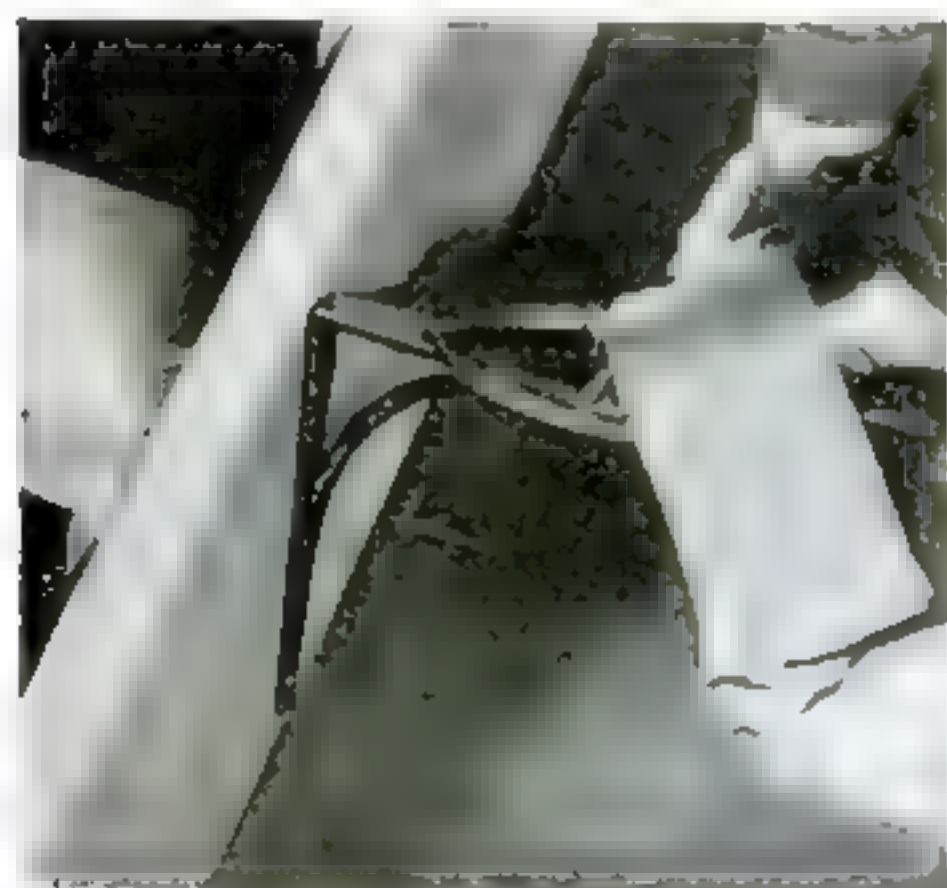
The double legs are made in the usual way, with a crosspiece to strengthen them and a brace from the top down to the crosspiece. The single leg is notched so that the horizontal piece can be set into it. This makes a joint that will stand up under heavy weights and hammering. All parts should be of oak or other hardwood, fastened with screws.—BROOKS HILL.

## Window Sills Protected with Plate Glass

WHEN flowerpots are placed on inside window sills, or window stools as they are called by carpenters, the finish often becomes badly marked because of spilled water. Pieces of salvaged plate glass, cut to fit the sill and used as shown below, give perfect protection and look well.—R. O. L.



A piece of scrap plate glass is cut to fit the window sill. This protects the finish



## Shoe-Shining Bracket

INSTEAD of using the cellar stair treads, a kitchen chair, the porch railing, or some other unhandy place for shining your shoes, make a permanent stand from a heavy iron shelf bracket. Fasten it to the stringer of the cellar stairs or in some other out-of-the-way place where no one will bump into it. Use heavy 1½-in. wood screws.

## Old Axle Used as Power Take-off Drive

STATIONARY machines may be inexpensively equipped to be operated by the power take-offs of tractors by use of discarded auto parts.

The belt-power stationary baler illustrated, for example, has been changed into a power take-off drive by use of an old auto axle. The differential was

locked by welding, the torque tube and shaft were cut off, a pulley fitted, and the belt applied. The baler may now be operated as it is drawn through the field or while stationary at the barn or stack without any lost time in "lining up" and backing into the belt. The baler may also be operated in a more limited space than was before possible and can be moved instantly whenever necessary.

This drive may be adapted to other stationary machines with equally advantageous results.—STANLEY RUSSELL.

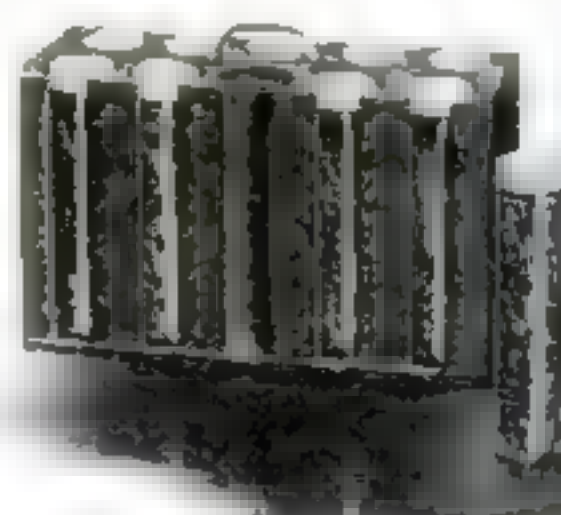


A belt-power stationary baler operated by the power take-off of a tractor by means of a drive made from an old auto axle

## Old Poker-Chip Rack Holds Hardware

AMATEUR craftsmen and model makers should be on the alert to obtain neat, convenient containers for small nails, screws, and other hardware. Various discarded articles intended for other purposes can be pressed into this service, as, for example, an unused

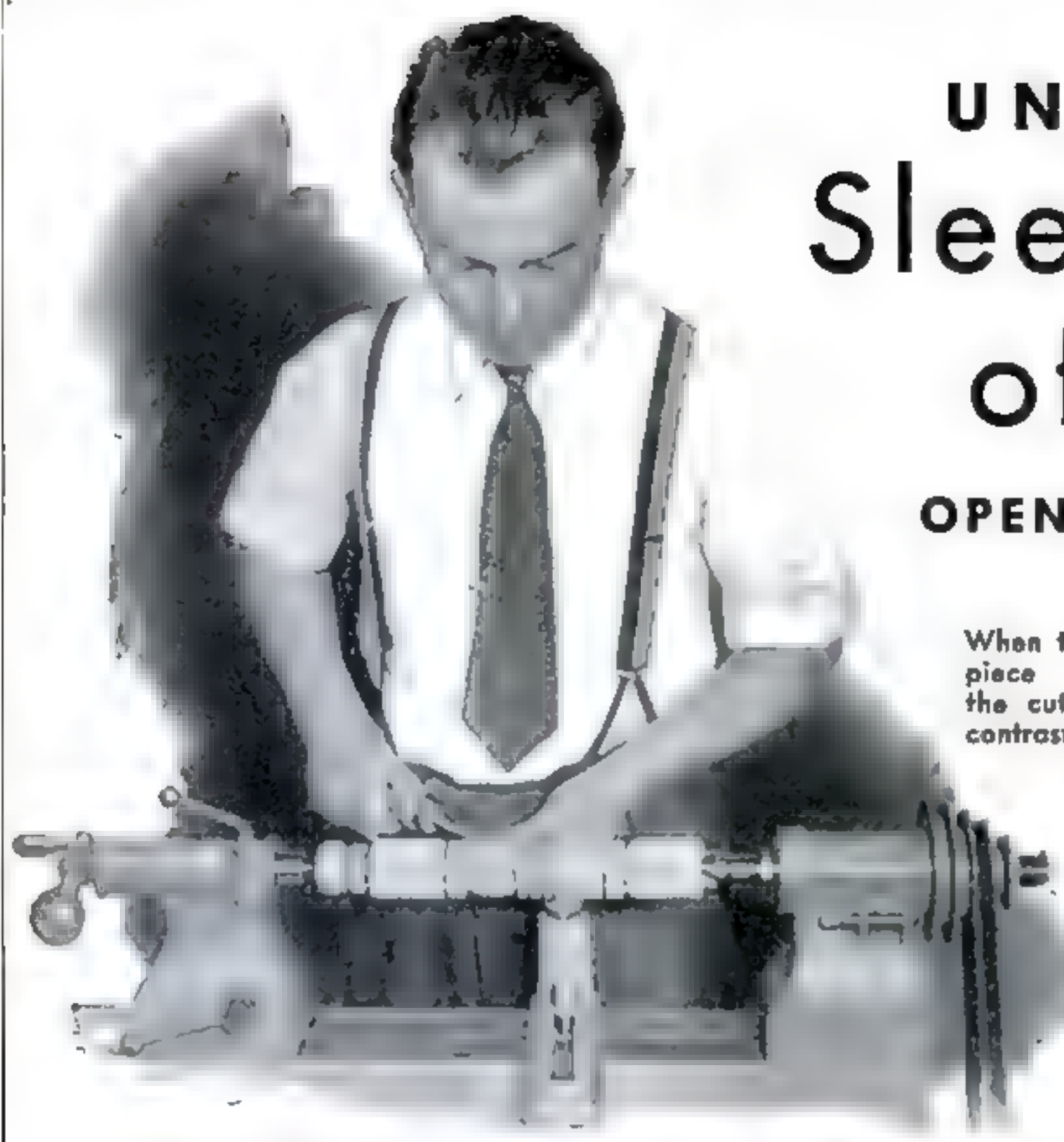
poker-chip rack. Bottles to fit whatever type of holder you get can usually be purchased at a drug store, where bottles of many heights and diameters are available.—C. H.



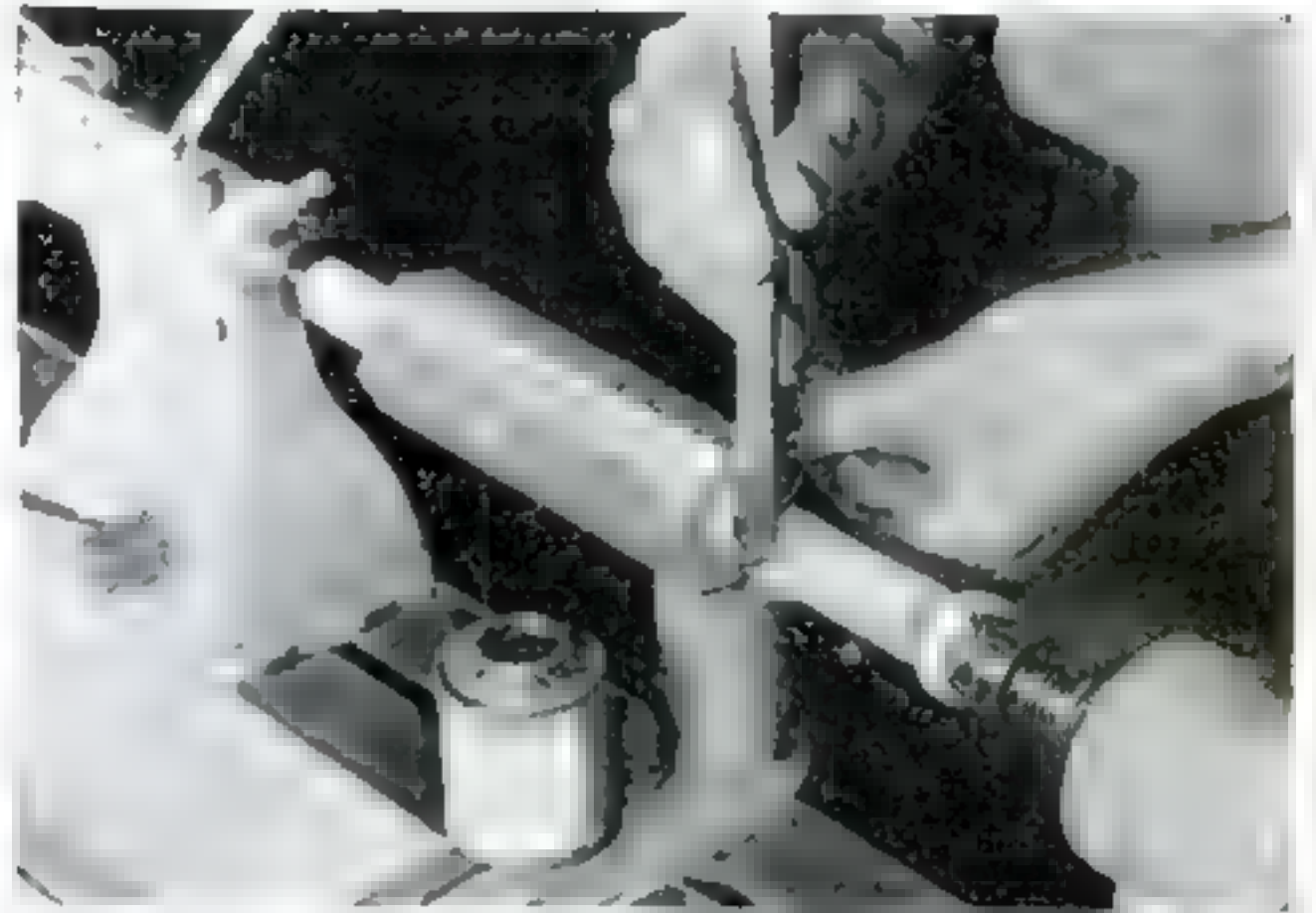


# UNIQUE Sleeve Method of Wood Turning

OPENS NEW FIELD FOR CRAFTSMEN



When the built-up piece is turned, the cuts reveal a contrasting wood



By HOWARD R. HEYDORF

**W**OODS of different colors may be combined by gluing pieces in various ways, but one of the most novel methods for building up the stock is shown in the accompanying illustrations. It is simple enough so that even the beginner will encounter no great difficulty in producing excellent work.

All that is necessary is to glue several wooden sleeves of graduated size, each over the next smaller one, to form a cylinder from which the article is finally turned to its finished shape. As one layer is cut through, the next one reveals a different wood, so the artistic possibilities are unlimited.

The cylinder is assembled upon a wooden centerpiece, which should preferably be made from one of the stronger woods. This is turned to the same size for its entire length. The cutting tool is best clamped between two blocks of wood, which are fastened together with bolts and wing nuts. If the tool rest is adjusted parallel with the work and the tool and the blocks are moved along it, a perfect cylinder can be formed.

The block from which the first sleeve is to be formed is drilled through its center for its entire length. The centerpiece is finish turned and then sanded till the drilled block will slip onto it easily but not loosely. Sanding of this type is best accomplished by folding a full-length sheet of sandpaper around a long, straight block of wood. This will remove any unevenness.

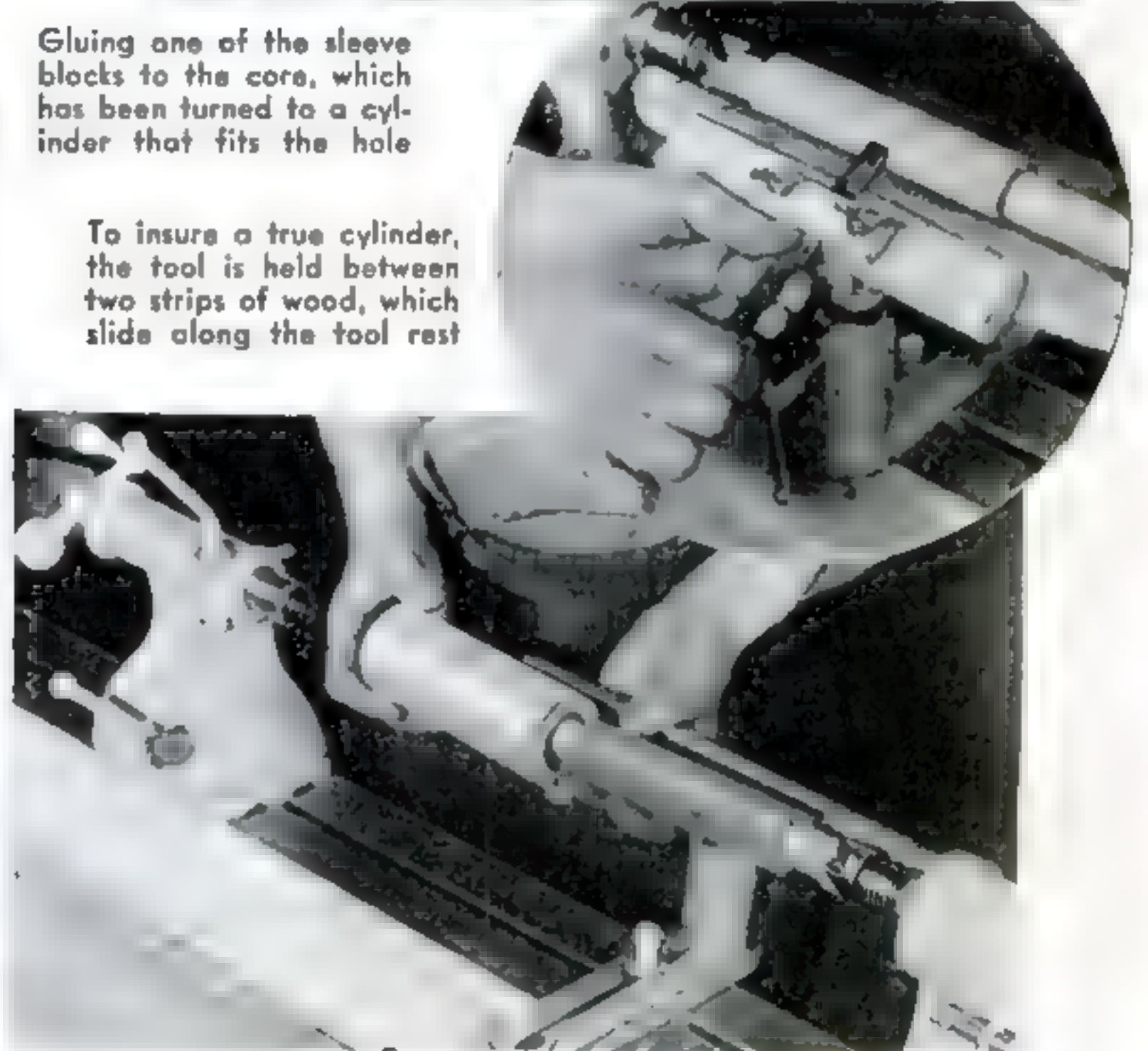
Now the first (*Continued on page 97*)



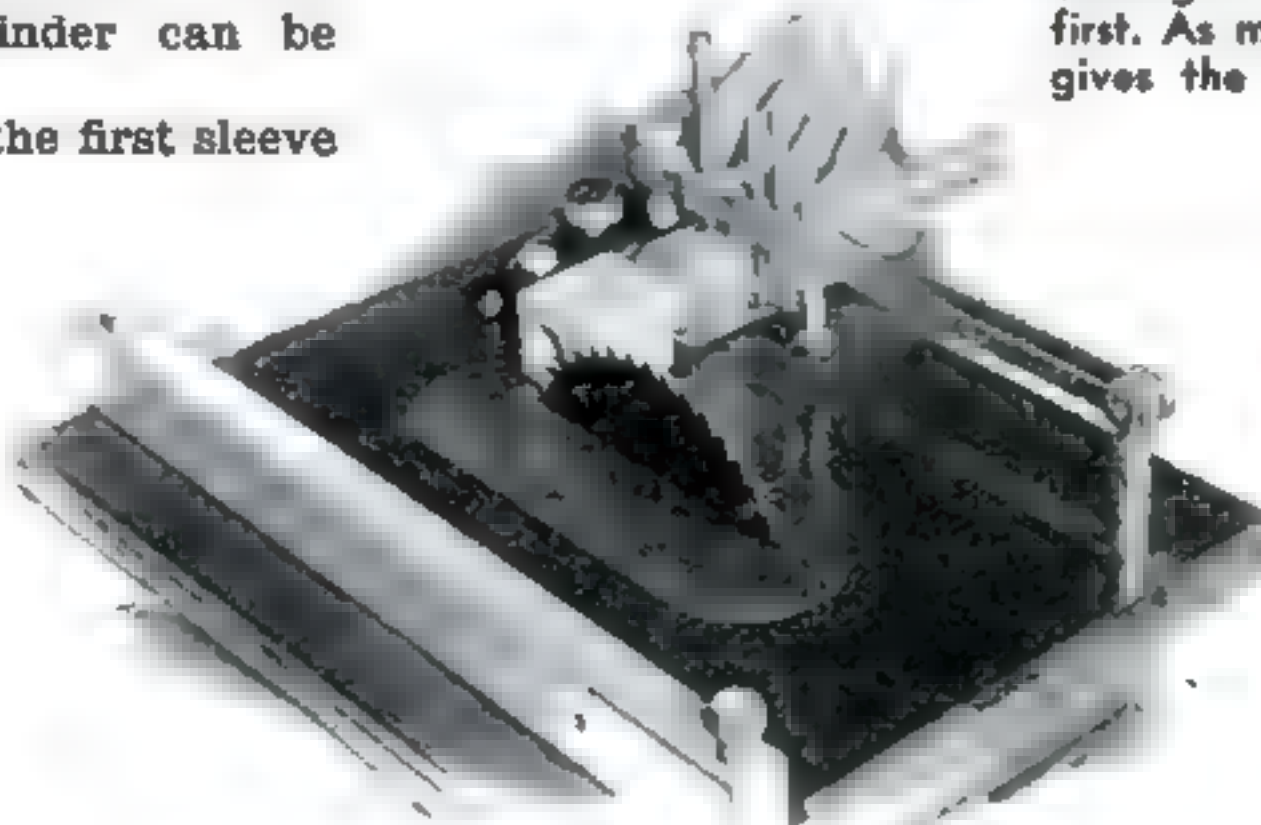
The finished turning for a furniture bench

Gluing one of the sleeve blocks to the core, which has been turned to a cylinder that fits the hole

To insure a true cylinder, the tool is held between two strips of wood, which slide along the tool rest

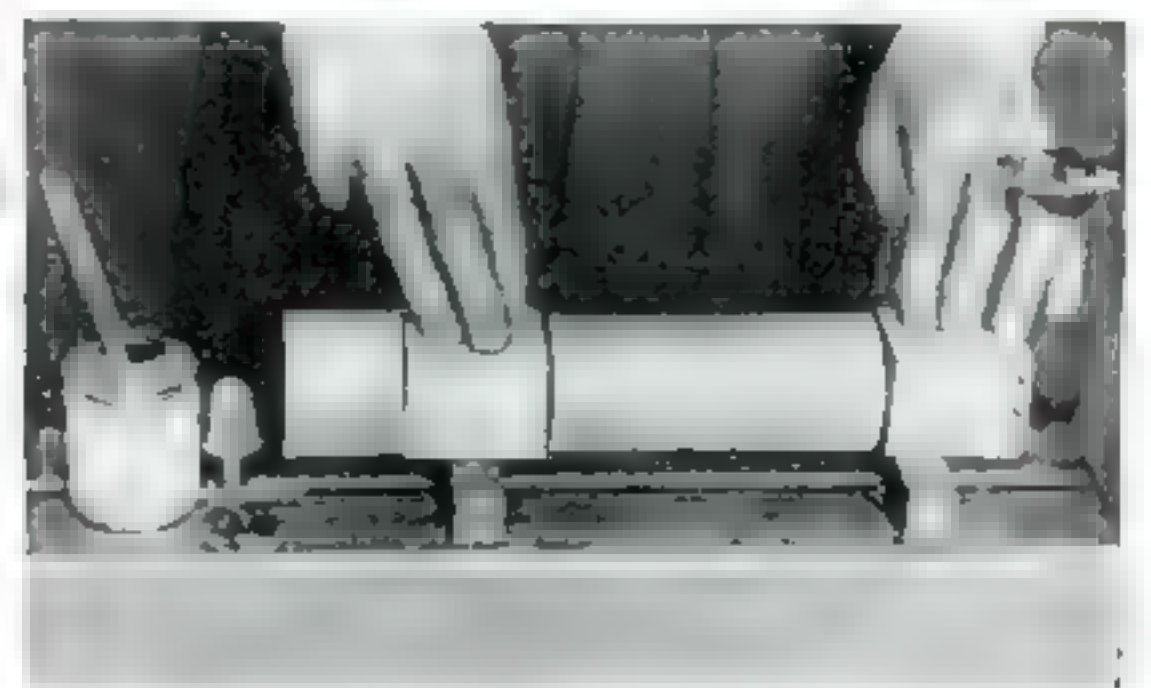


Testing the fit of a second sleeve to be glued on the first. As many sleeves may be added as needed. This gives the finished piece the effect of being inlaid



After each rail block has been drilled, it is slipped over the end of the core and trimmed square on the saw. This square end is a guide for the other cuts

In the case of the small bench leg, two squared-up blocks are glued on as shown below, and are adjusted by resting them on strips of wood on a true surface



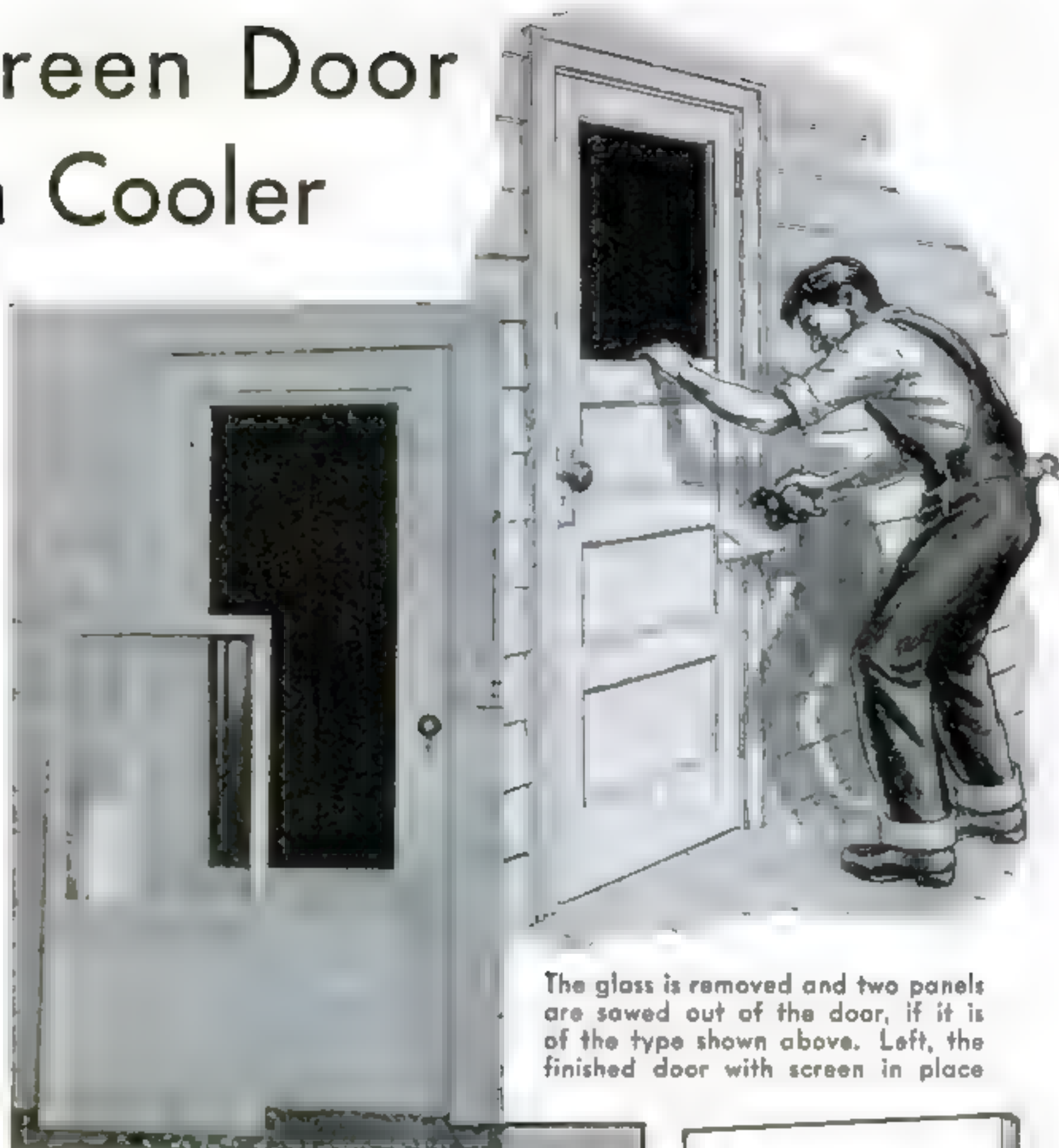


# Combination Screen Door Keeps Kitchen Cooler

IN THE warmer sections of the country where a screen door is all that is required at the kitchen entrance from early spring to late fall, it is a simple matter to alter an ordinary kitchen door of the type illustrated so that it becomes, in effect, a screen door during the summer and a regular door during the winter. If greater security from intrusion is required when no one is at home, the glass panel can be used on the inside and fastened with catches or small door bolts.

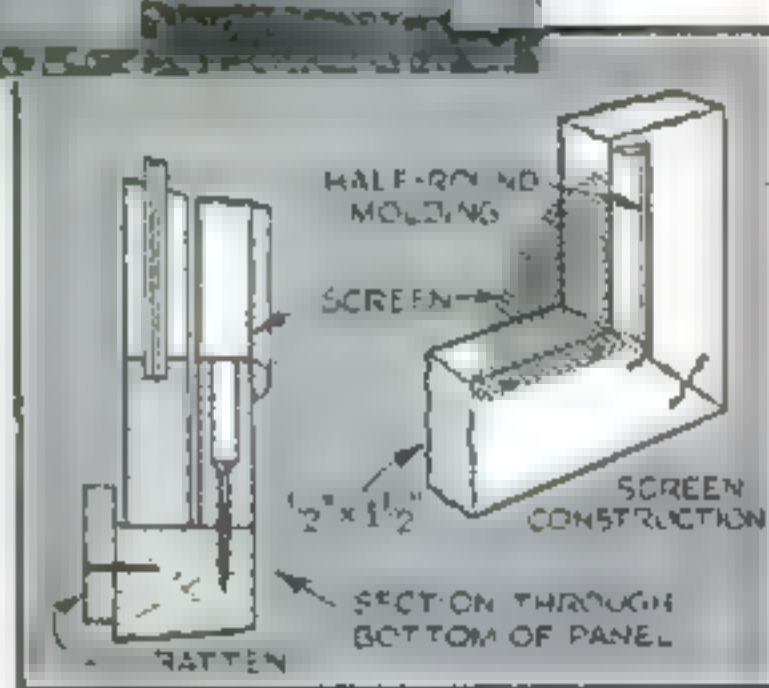
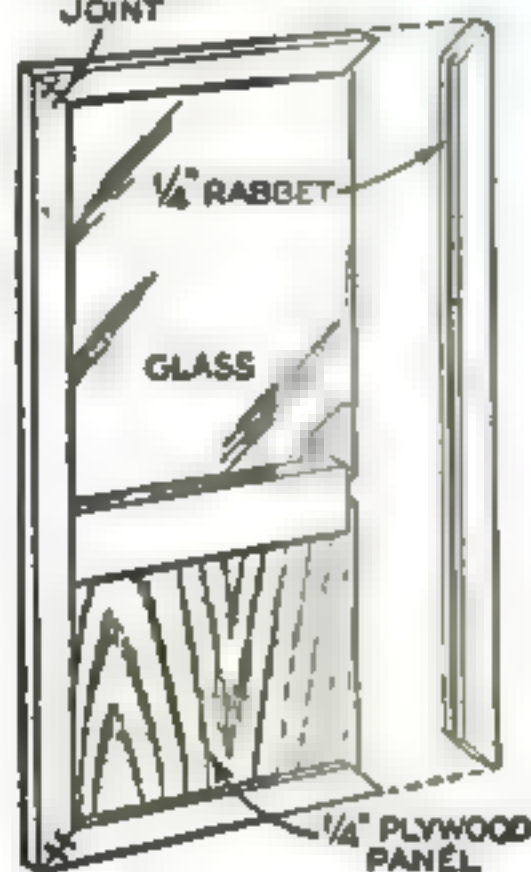
Remove the glass and saw down through two panels as shown; then smooth the edges of the opening with plane and sandpaper. Construct a screen frame of light material in any way desired. Perhaps the quickest and simplest way is to miter the corners and join them with corrugated fasteners. If fasteners are used, be sure the frame is laid on a perfectly flat surface, such as a clean garage floor or driveway, when driving them home. After the screen wire has been tacked on, the frame is secured in the opening with countersunk screws.

The screen is left permanently in place, and a removable storm panel is made for use in the winter or during wind and rain storms. The outside members of this frame are  $\frac{3}{4}$  by  $1\frac{1}{2}$  in., but it is better to have the center rail somewhat wider. The parts are rabbeted  $\frac{1}{4}$  in. deep for the plywood panel and the pane of glass, and the latter is puttied in tightly after being set in the rabbet. This frame is held at the bottom by a batten and at the top with two door buttons.—HI SIBLEY.

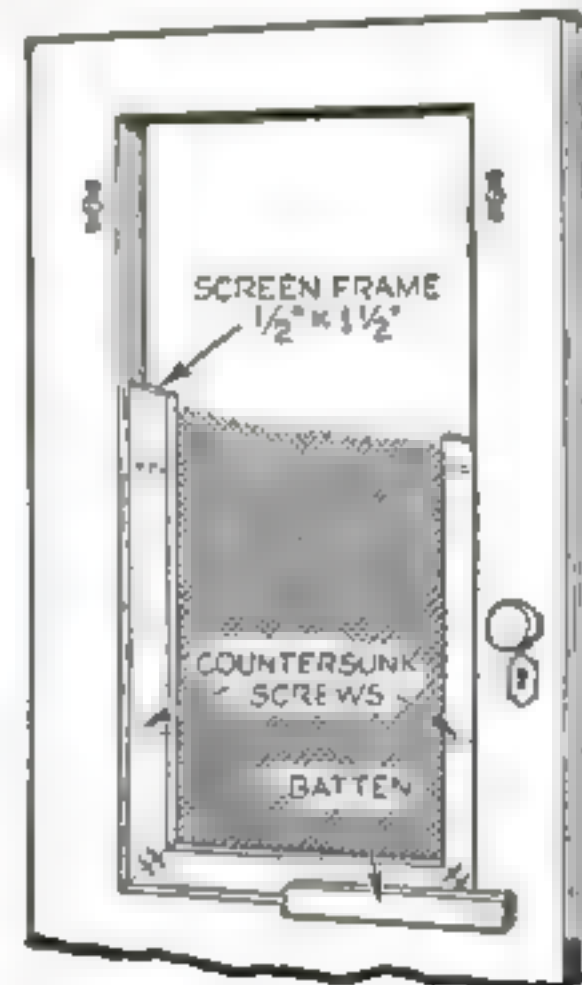


The glass is removed and two panels are sawed out of the door, if it is of the type shown above. Left, the finished door with screen in place

CORRUGATED FASTENERS HOLD MITER JOINT



The glass frame is made as at the left, the screen as at the right. Above, section showing frames in place and detail of the screen



## Blackboard Behind Bench Used for Shop Sketches

ON THE wall of my shop, directly behind my bench lathe, I have a 4-ft. square piece of wall board, painted with blackboard paint. On this I can quickly chalk a rough design, note important measurements, or attach drawings with thumb tacks.—M. L. FULLER.



The lower portion of the distributor cap may be partly filled with plaster to add weight. At right, how the pencils are held



## Handy Desk Pencil Holder and Paper Weight Made from Old Auto Distributor Cap

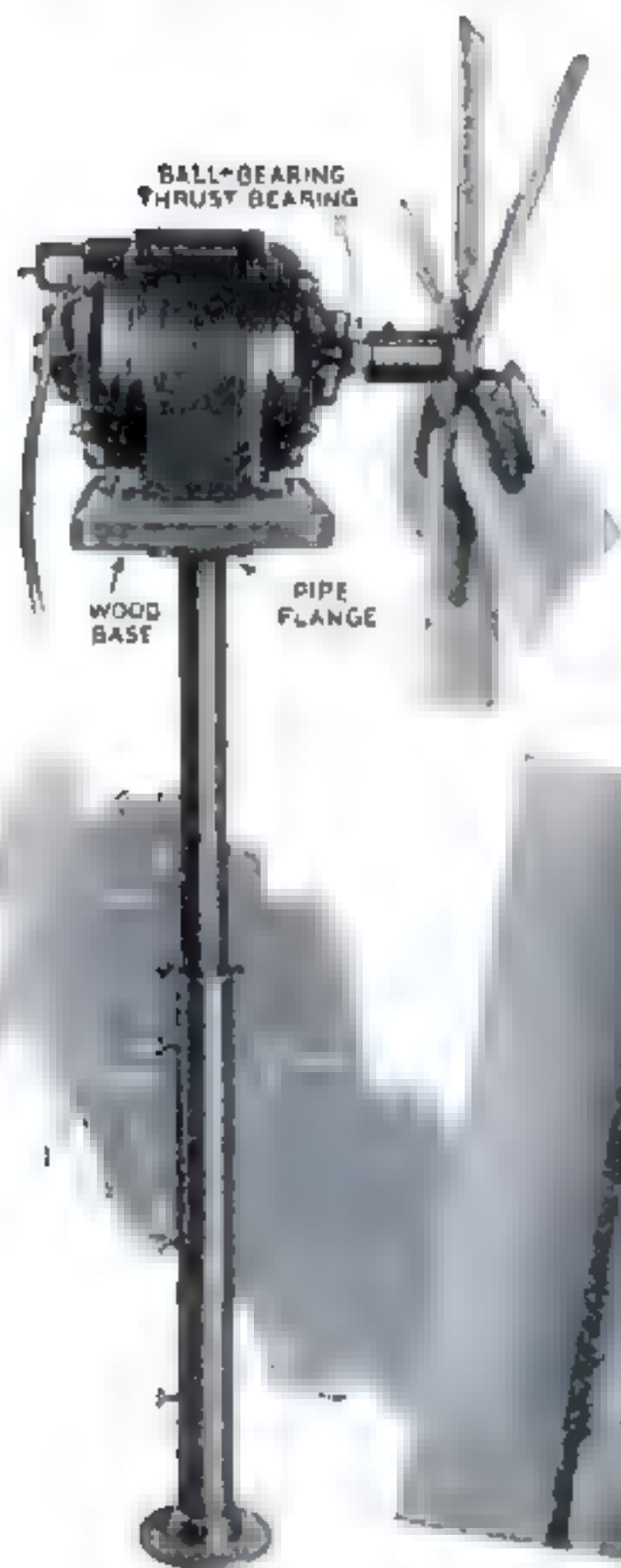
A DISCARDED automobile distributor cap makes a practical combination paper weight and pencil holder. The smooth rim of the hard composition cap slides easily over papers as they are slipped under or drawn from beneath it; and the pencils, held vertical by the ignition-wire sockets, are conveniently spaced and always handy. A suitable cap may be obtained for the asking or a nominal price at almost any automobile repair shop.

Although such a cap is usually heavy enough in itself to serve as a paper weight, it can, if necessary, be partly filled with plaster of Paris to increase the weight. The cap should not be entirely filled because the plaster might rub off on the papers held down by the paper weight. For extra weight, imbed shot in the plaster.—E. L. B.



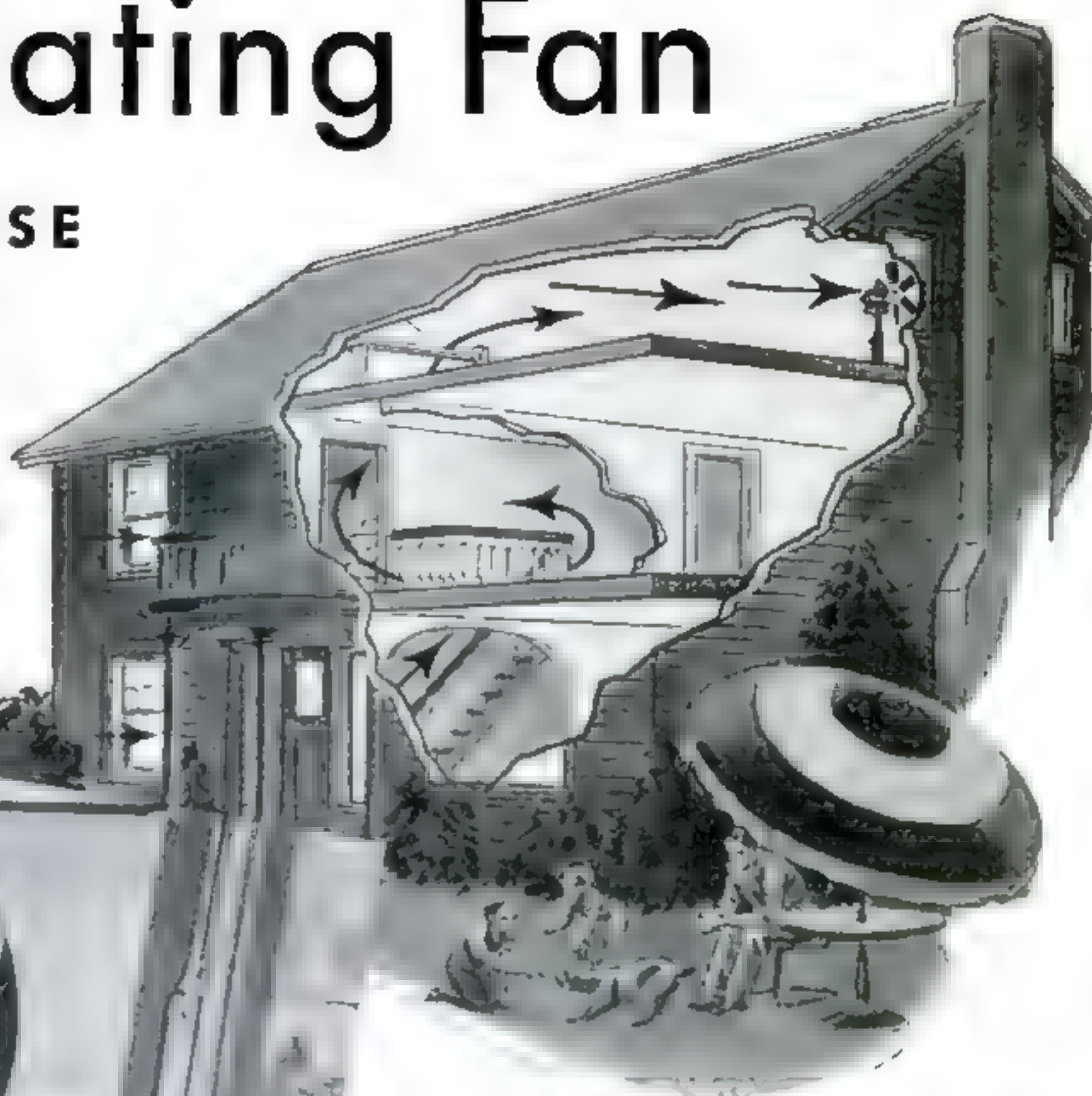
# Attic Ventilating Fan

**AIRS HOUSE  
QUICKLY  
AFTER  
HOT  
SUMMER  
DAYS**



PLYWOOD

SCREEN



An old auto-engine fan, installed as at the left, is turned on in the early evening to draw out the superheated air from the attic, as shown above

**By J. L. BIRD**

**I**N SUMMER, the average attic is a storehouse of heat. It may be thirty or forty degrees hotter than the remainder of the house. This heat penetrates through the ceiling of the rooms below and often makes the sleeping and living quarters almost unbearably warm. Even after the sun goes down, it takes hours for natural ventilation to cool the rooms.

It doesn't require an expensive air-conditioning plant to correct this condition. All that is necessary is to install an attic fan to force the superheated air out and suck in, through the open windows of the remainder of the house, the cooler outside air.

By operating the fan from early evening until time to retire, the average bedroom will become cool enough for comfortable sleeping during most summer nights. When the weather is exceptionally hot, it may be found desirable to run the fan all night. In the warmer sections of the South, attic fans are operated twenty-four hours a day to get the cooling effects of the circulating air.

The cost of a commercial attic-fan installation might be somewhat of a shock to the amateur craftsman who is familiar with motor-powered equipment, but the attic fan to be described can be constructed for much less. Although it may not have all the features of the purchased unit, it will certainly pay the builder valuable dividends in summer comfort.

The fan should have a capacity suffi-

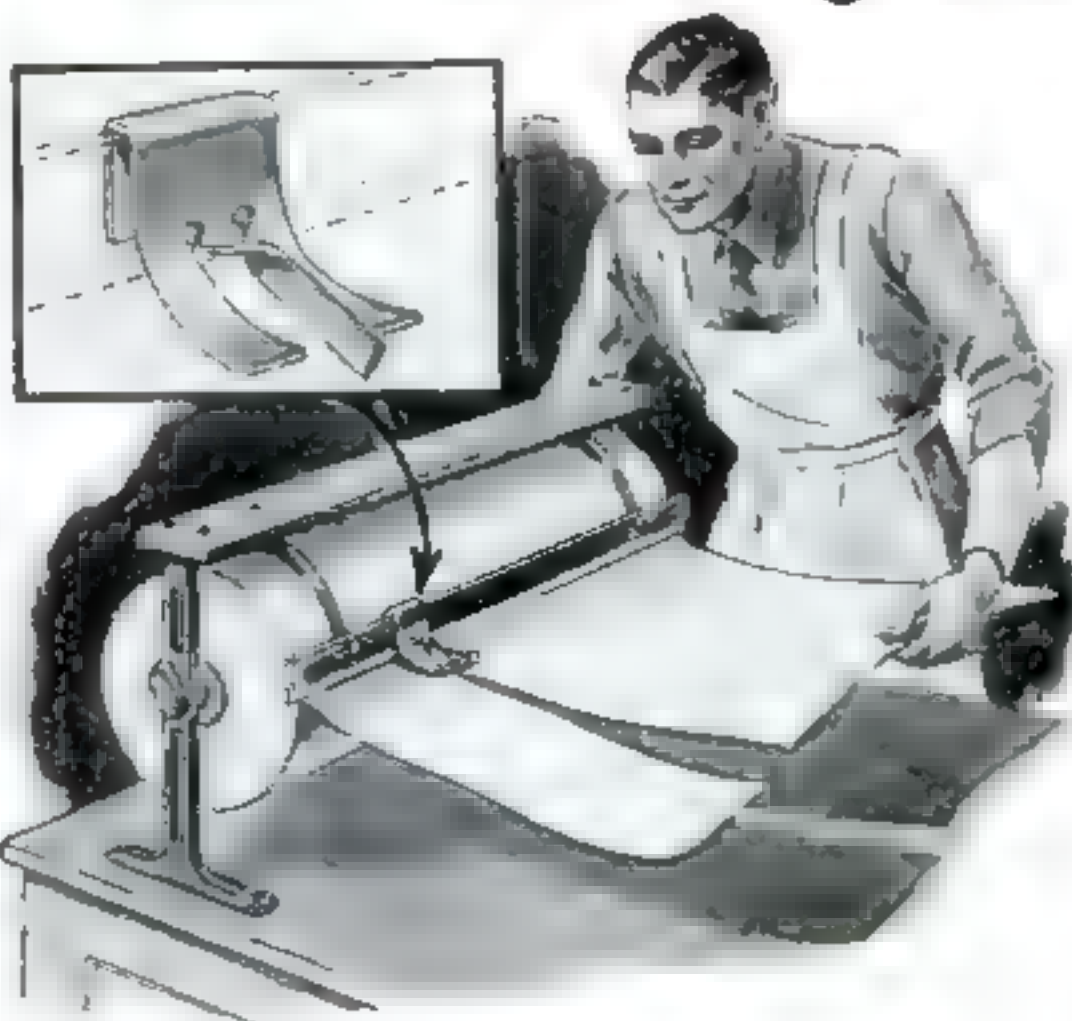
cient to change the air in the entire house completely at least twenty times an hour. The minimum motor rating is  $\frac{1}{8}$  h.p. The unit shown uses a  $\frac{1}{6}$ -h.p. motor operating at 1,140 r.p.m. The fan blade assembly is  $20\frac{1}{2}$  in. in diameter, and is the engine fan of a well-known make of automobile. It was purchased from an auto junk yard for one dollar. The installation was made in the attic of a medium-size, seven-room house and produces an estimated thirty complete air changes an hour.

When the builder is selecting the motor and fan, he should consider the

noise factor as well as the air capacity. Probably most home workers will use a 1,750-r.p.m. motor; in fact, a shop motor that is not in great demand during the summer months might be used. A large, multibladed fan, unless it is of the latest noiseless type, will make some noise when operated at high speed. It is suggested that a four- or six-blade fan 16 or 18 in. in diameter be used with a  $\frac{1}{4}$ -h.p., 1,750-r.p.m. motor. If a 1,140-r.p.m. motor is available, it will be possible to swing a larger diameter fan with less noise and the same air delivery.

It will probably be necessary to alter the fan hub to fit the motor shaft. If equipment is not available, a machine shop will make the alterations for a nominal sum. (*Continued on page 113*)

## Cutter for Slitting Roll Wrapping Paper



**MADE** in a few minutes from a 3-in. piece of 1-in. band iron, with the aid of a flat file and a pair of tin snips, the cutter illustrated is hooked on the shearing blade of a wrapping-paper holder of the ordinary commercial type. It may then be moved along the blade for cutting various widths of paper, thus saving the waste that occurs when wider paper than needed is used for small parcels. Another use for the device is when long, narrow strips have to be prepared for window or counter decoration. All that is necessary is to hook one or more cutters of the same type to the shearing blade.—CHARLES M. RICE.



It was with a homemade yacht of this design that my son won the 1936 championship of Greater New York in Class 6 for constructed models up to 30 in. Identical models have also been winners in a number of other contests.

First, lay out a working board  $\frac{3}{4}$  by 8 by 31 in., as shown. Cut mold block 1 and wedge block 2 to shape and join temporarily with two screws so that the notches cut for the keel fit opposite each other. Cut keel and stem in one piece, then bevel as shown, and drill hole at *F*. Place on working board so bow end of keel is at *A* and stern side of mold block on line *BC*. Apply glue to keel at *A* and *F*, to mold block at *BC*, and to stern block at *DE*. Allow to set overnight.

How frame is set up. To give a natural shear curve to the side planks, a 1/4-in. thick stick can be placed across the working board under the wedge block.

[illegible]

POPULAR SCIENCE MONTHLY



# Won a Championship

site side of keel. Fasten piece 6 at *E*, bend around the double blocks to stem at *A* outside of piece 5. Trim to make a tight fit, fasten 6 to stem with two screws, then fasten 5 to 6 with two screws. Always drill holes before inserting screws. Fasten stern block to keel with screw at *F*.

To remove frame from board, take out screws holding wedge block to mold block and with a thin hack-saw blade, saw away the glued parts at *A* and *DE*.

Drill a  $\frac{1}{8}$ -in. hole through keel vertical to deck  $7\frac{1}{2}$  in. from stern, and on inside of keel drill a  $\frac{1}{4}$ -in. hole  $\frac{1}{8}$  in. deep for rudder-stock tube. Fit deck beam into notches in stem piece, wedge block, and stern block, and fasten with screws. Drill a  $\frac{1}{4}$ -in. hole in line with hole in keel and insert the rudder-stock tube in place.

Mark points on center of deck beam at crossbeam sections and measure to outside edge of the two side planks; then force these planks to either side as necessary so that both outside edges are equidistant from deck beam.

Attach cross beam in front of rudder tube with a screw through center of deck beam and with toothpicks wedged through the side planks. Insert a beam  $9\frac{1}{2}$  in. from bow between keel and deck beam, and in front of this attach another cross beam. Apply wood composition around rudder tube at keel to prevent any water from leaking into the hull.

Attach coarse sandpaper to a 6-in. block of wood. Starting at bow, with one end of block resting on keel and other end on side plank, finish edges parallel on an even curve from bow to stern. Cut bottom plywood planks to approximate shape, apply thin layer of boat-seam compound to edges of side plank, and bind one of the bottom planks to frame at bow and stern with wire. Hold a 75-watt lamp inside hull to see where to drill holes for toothpicks used to attach bottom plank to side and keel. Use an automatic hand

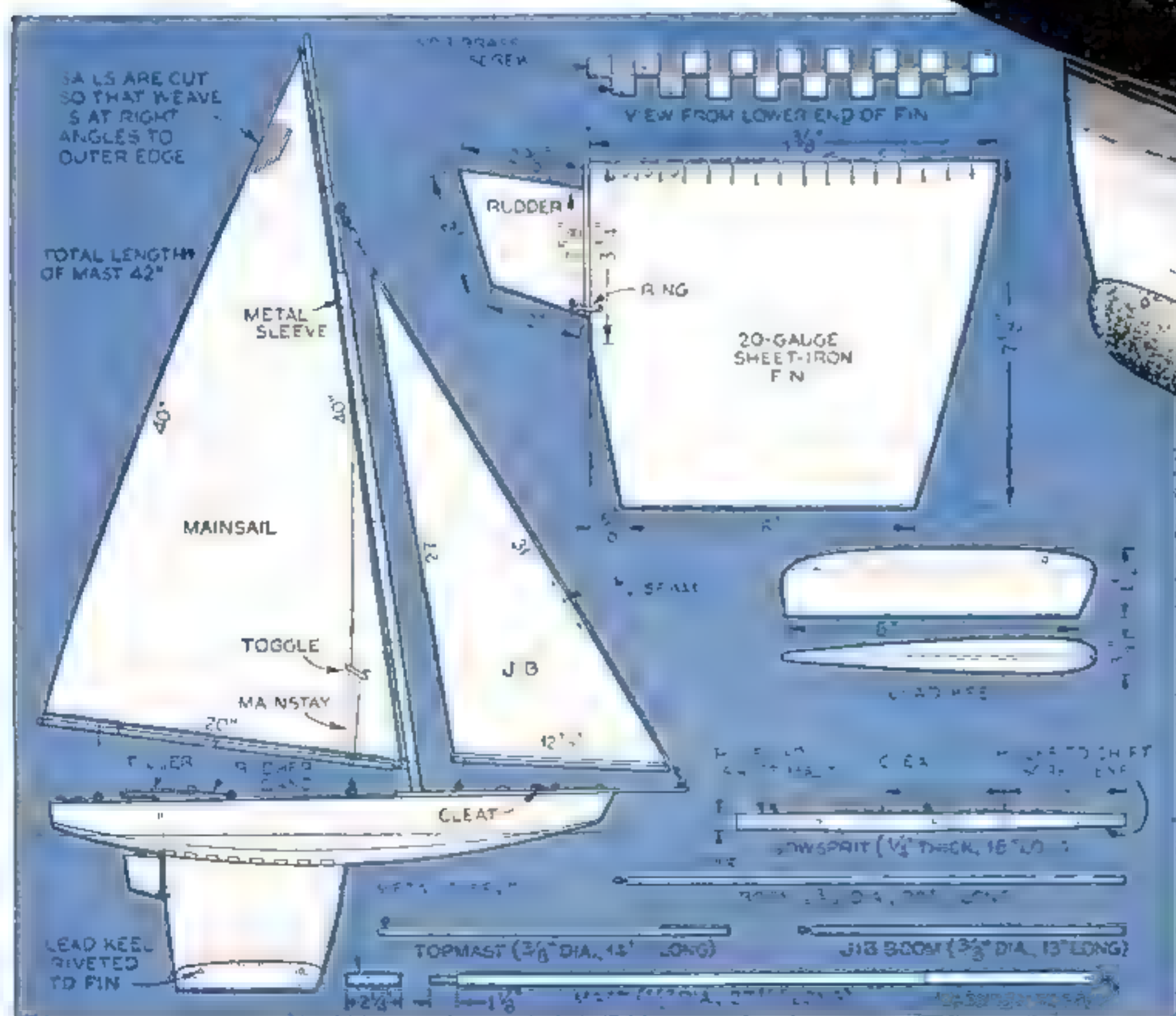
push drill with No. 2 drill, and make the holes  $\frac{1}{2}$  in. apart. Cut toothpicks to proper length and thickness, dip in shellac, and, starting at the center, hammer them into the holes. Trim off flush and sandpaper.

After the plank is properly attached, cut it flush with side of boat and off center along (*Continued on page 103*)

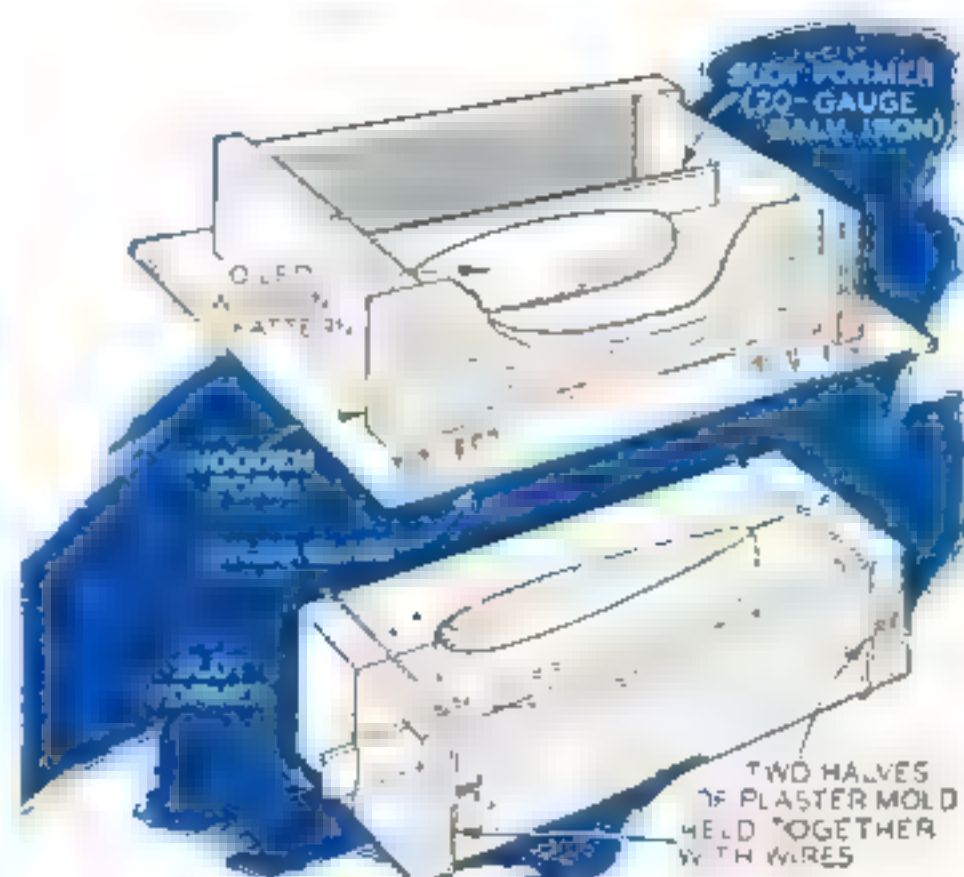


Unusually speedy as the boat is, the construction is of a simple type, well adapted to the beginner

By BERNARD FISCHLER

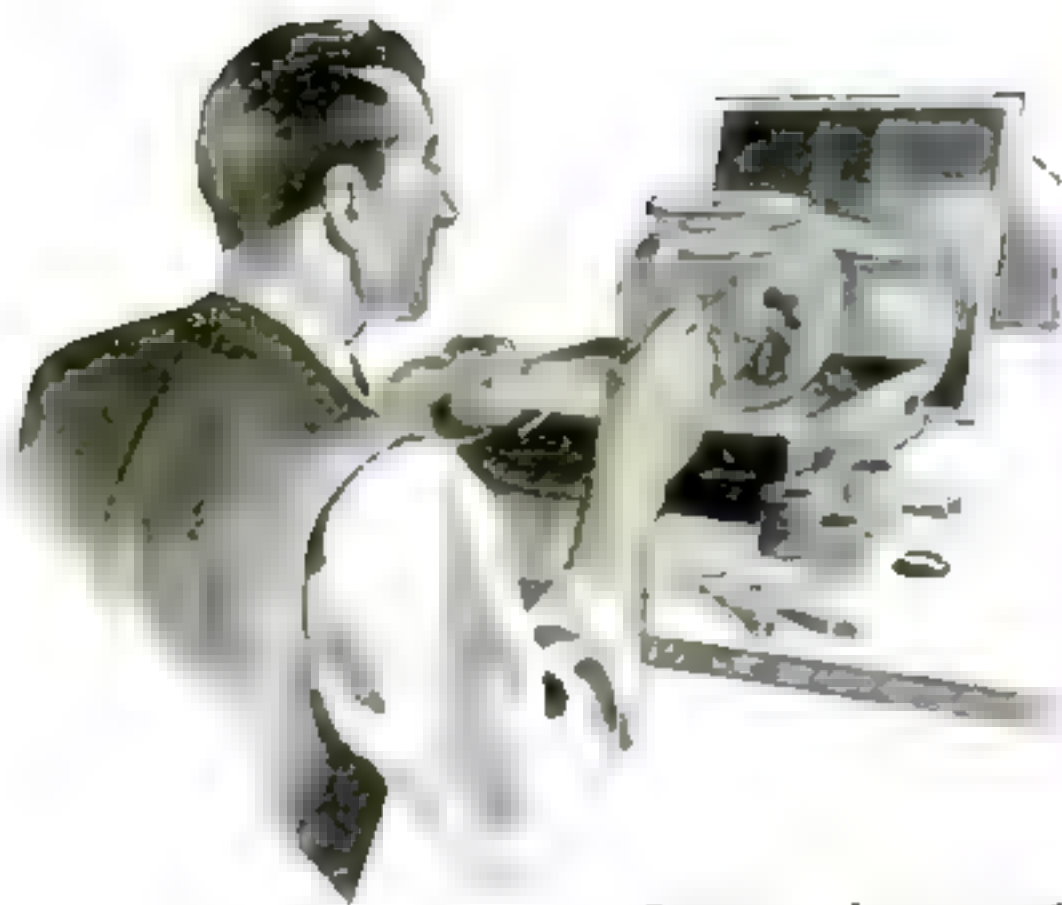


Sketch showing the bowsprit with holes for shifting mast, and the automatic steering device. Below, how mold for lead keel is made





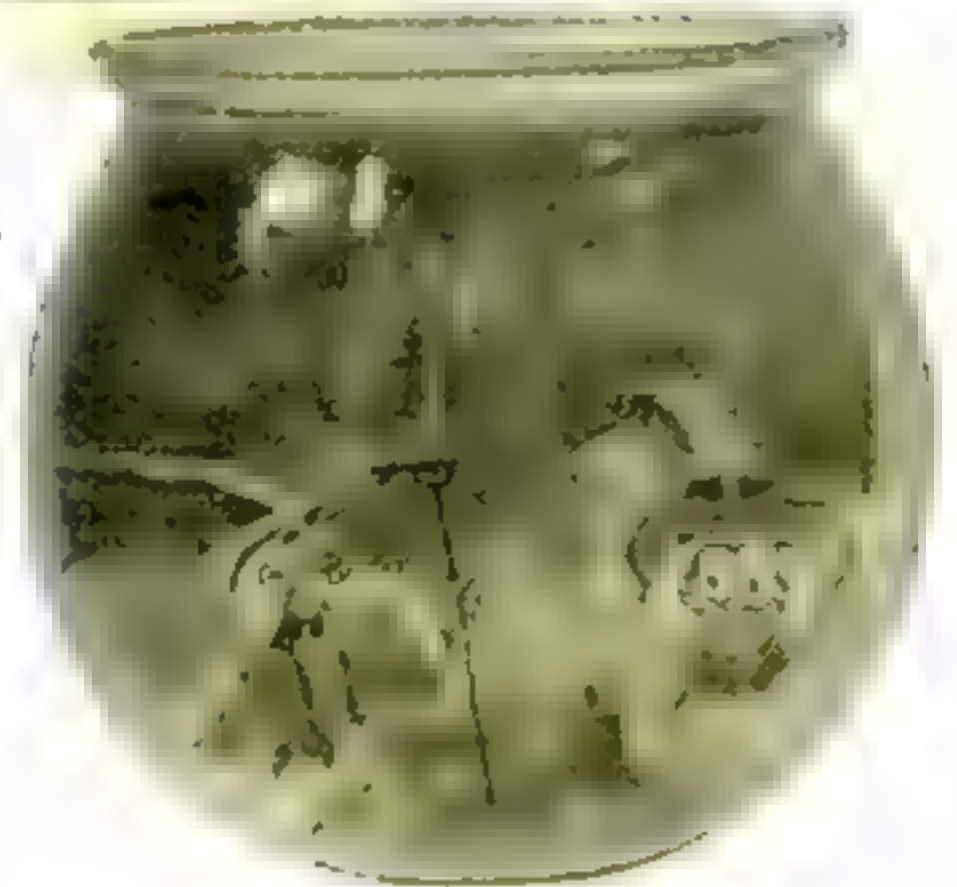
# Fish-Bowl Funnies and



Painting the water-filled bowl with a mirror set up to show how the work will appear from the front. Fairy-tale scenes are especially appropriate



When viewed through the water, all the scenes appear grotesquely magnified and have a third-dimensional aspect. The dwarfs, for example, look to be right inside the bowl



An unlimited number of pictures can be adapted to this type of work. Another unusual effect can be gained by painting small castles and leaving the windows clear. After the picture is dry, small pieces of bright foil are glued over the windows.—ARCHIE HANSEN.

BY PAINTING various scenes, odd pictures, or comics on one-half the outside surface of small, spherical-shaped fish aquariums in the manner illustrated, many beautiful or weird effects may be obtained without special artistic skill. Because of the spherical shape of the bowl, the pictures appear to have a third dimension, and any distortion that may be present when the picture is not viewed from its focal point, seems to enhance, rather than detract from, the completed view.

Several small brushes, some quick-drying varnish, and a few tubes of regular artists' oil colors or quick-drying enamels are the only materials required.

First, fill the bowl with water and ar-

range it with a mirror behind, as shown. The water has a tendency to enlarge the actual painting, and as the work progresses, the magnified results are constantly viewed in the mirror.

If the picture is to be a simple landscape or something of that type, paint the objects that appear in the foreground first, and work by stages to the background, allowing sufficient time for each object to dry before painting the part immediately behind it. The sky, of course, is painted last. Beautiful cloud effects are created by brushing through the sky paint while still wet with white and shades of gray. After the picture is thoroughly dry, it should be given a coat of some light shade of opaque paint, preferably cream.

## Costume Brooches Cut from Sheet Copper in Shape of Oak Leaves

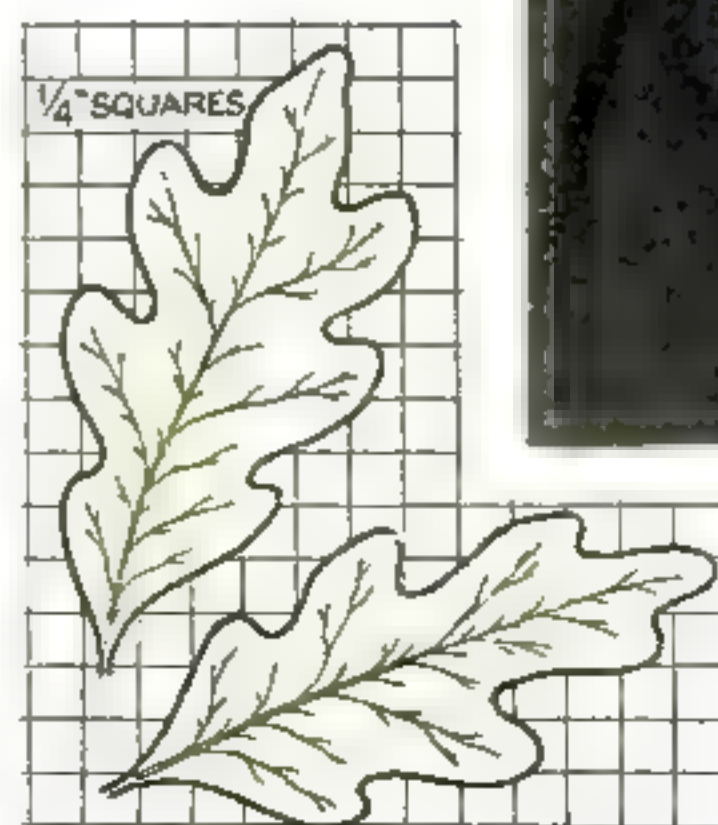
AN OAK-LEAF brooch cut from sheet copper and oxidized to a deep, rich brown makes an attractive piece of costume jewelry. The color closely resembles the natural russet of a real oak leaf in late autumn. Each brooch may be individualized by using a different leaf.

The metal should be soft sheet copper of approximately No. 18 gauge. Trace the leaf on the copper with a lead pencil, and cut it out in the rough with a pair of tin snips. Finish the design accurately with files and fine emery cloth. If you have a jeweler's saw, you may prefer to saw out the design, in which case very little filing will be necessary.

The veining lines are first marked with a lead pencil, then indented with a blunt cold chisel, or any tool, such as a screw driver, that has first been filed or ground to produce the desired effect.

After the design has been finished, the metal

should be planished with a smooth, flat-faced hammer in order to harden the soft metal. The metal should then be thoroughly cleaned with a household scouring powder, and finally with soap and water. To oxidize it, lay the design, face up, on a hot metal surface, such as the top of a cooking stove, and heat it just long enough to cause the copper to take on the desired russet color. When cool, polish the metal with a cloth, and coat the face with clear lacquer or thin varnish. The fastening device may be taken from a discarded brooch.—GEORGE A. SMITH.



Left, two patterns. Extreme left, filing the cut edges. Above, one of the finished brooches



# Other Craftwork Ideas

## Decorated with Indian Drummer Boys

Other

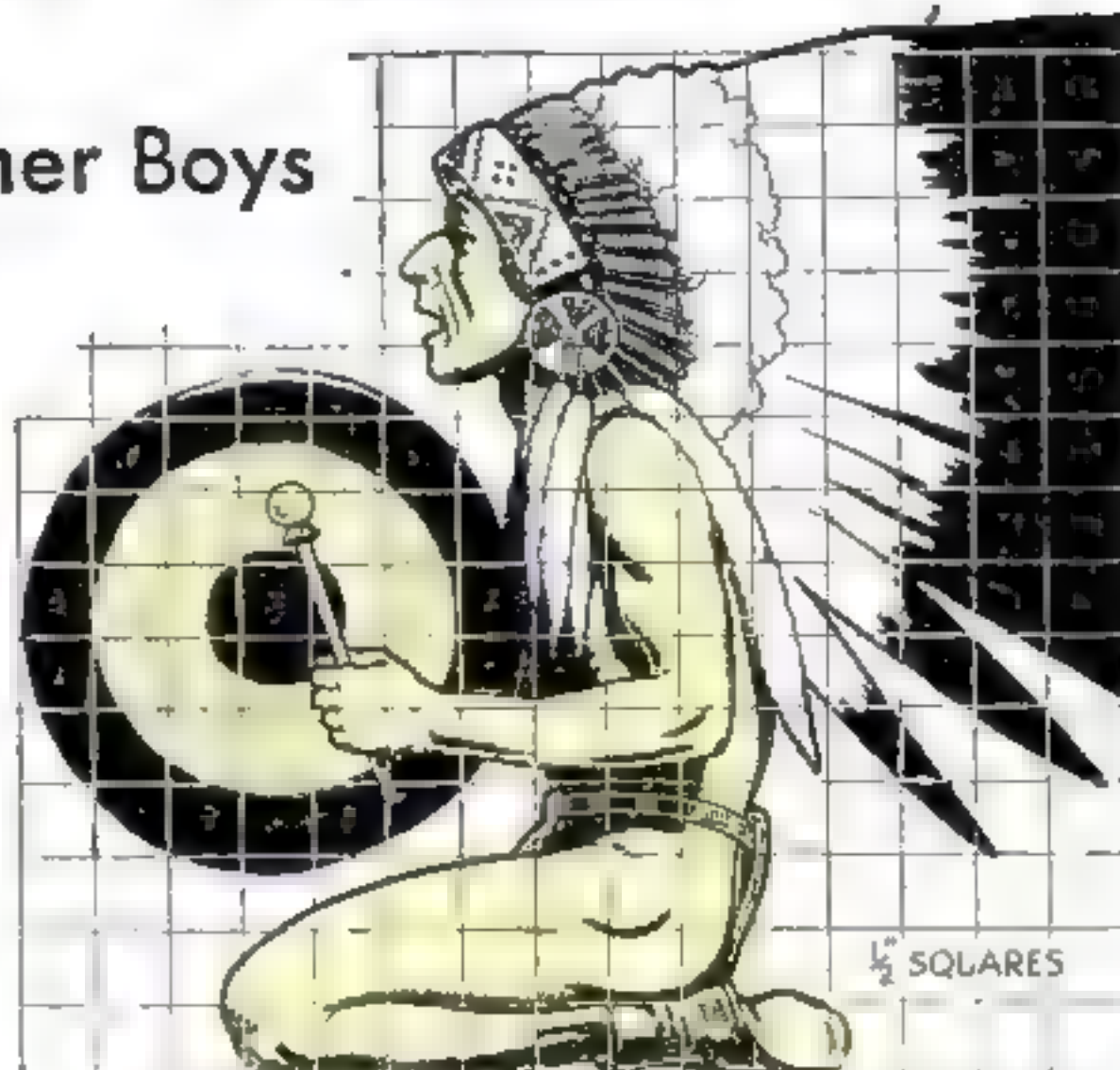
Change their  
their own  
as designed

angle through the top of each  
headdress into the upright.

Sandpaper the whole thoroughly, rounding the corners slightly, and fill all nail holes. Paint the upright any color suitable for the room in which the coat rack is to stand.

Color the boys brown and the shadows black. The feathers are white with black tips; the fur, white. The base or quill ends of the feathers are red with a yellow spot below. The brow band is white with a design in red and light and dark blue. The belt has green edges and a blue and red design, and the breech clout looped over the belt is red with yellow edges.

Moccasins have a brown sole, then a strip of white



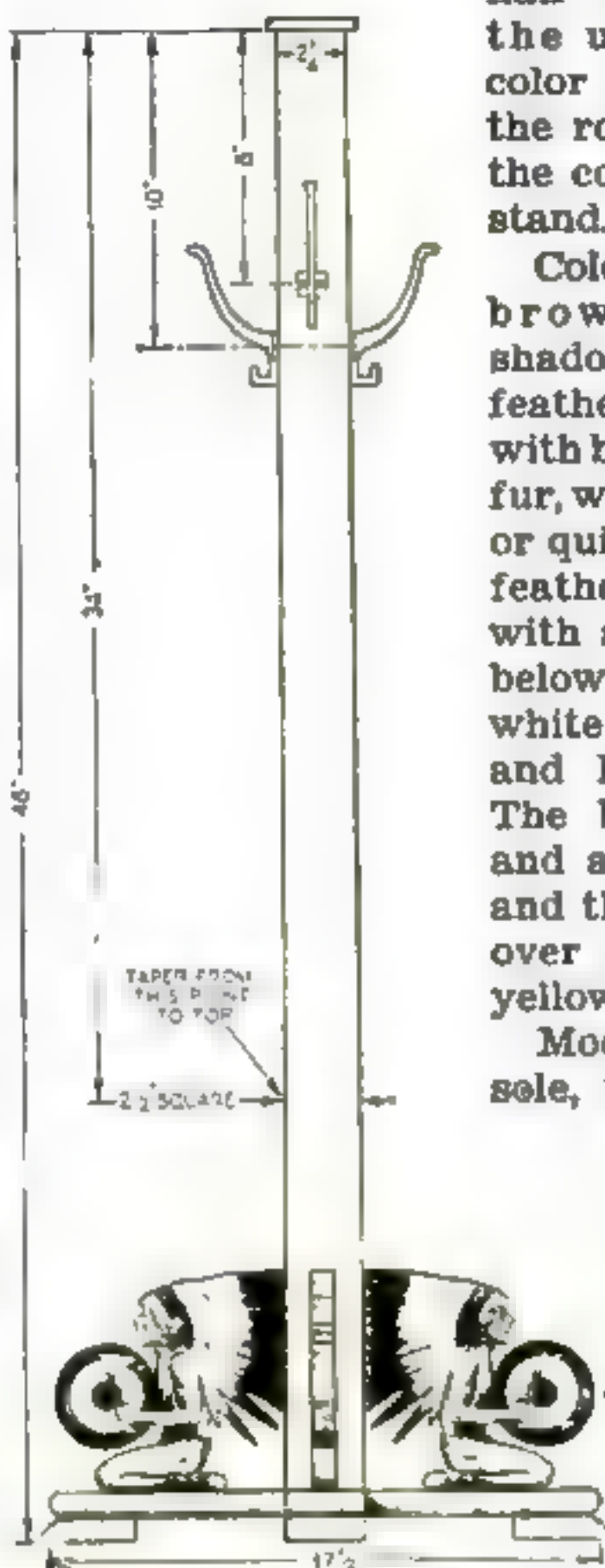
Drummer-boy design on squares for easy enlargement

the figures, then turn over the sheet of paper containing the full-size drawing and trace the design on the reverse side of each cut-out part.

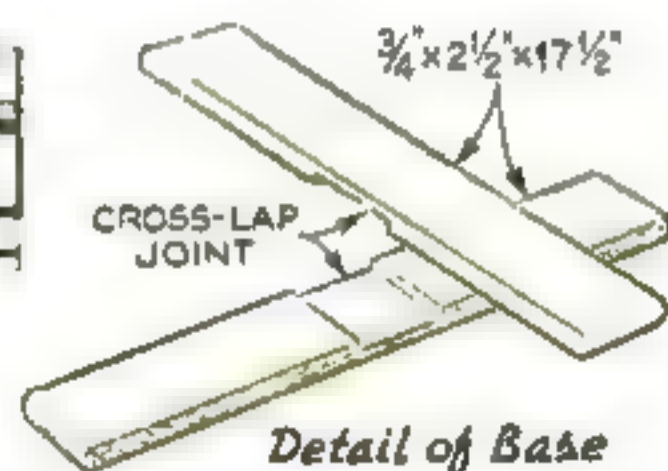
The upright, 3 ft. 10 1/2 in. long, is 2 1/2 in. square for 12 1/2 in. at the lower end. It then tapers to 2 1/4 in. square at the top. A block 3/4 by 2 1/2 by 2 1/2 in. is nailed to the top of the upright.

For the base, two pieces 3/4 by 2 1/2 by 17 1/2 in. are needed. They are assembled with a cross-lap joint as shown. The four feet, each 3/4 by 2 1/2 by 3 in., are then nailed in place, and the base is fastened to the upright from below with two large wood screws.

The four Indian figures are nailed to the cross bars from the bottom, and a long, thin brad is driven at a downward



The assembled coat rack, side and end views of feet, and base members



with a blue design. Over the instep is a red and yellow striped design, and the cuff is tan with a red edge. The drumstick has a green handle and a red ball. The center of the drum is black, next there is a broad yellow ring, and the outer rim is red.

When the paint is thoroughly dry, give the whole project a coat of transparent varnish.—GRAY WOLF.

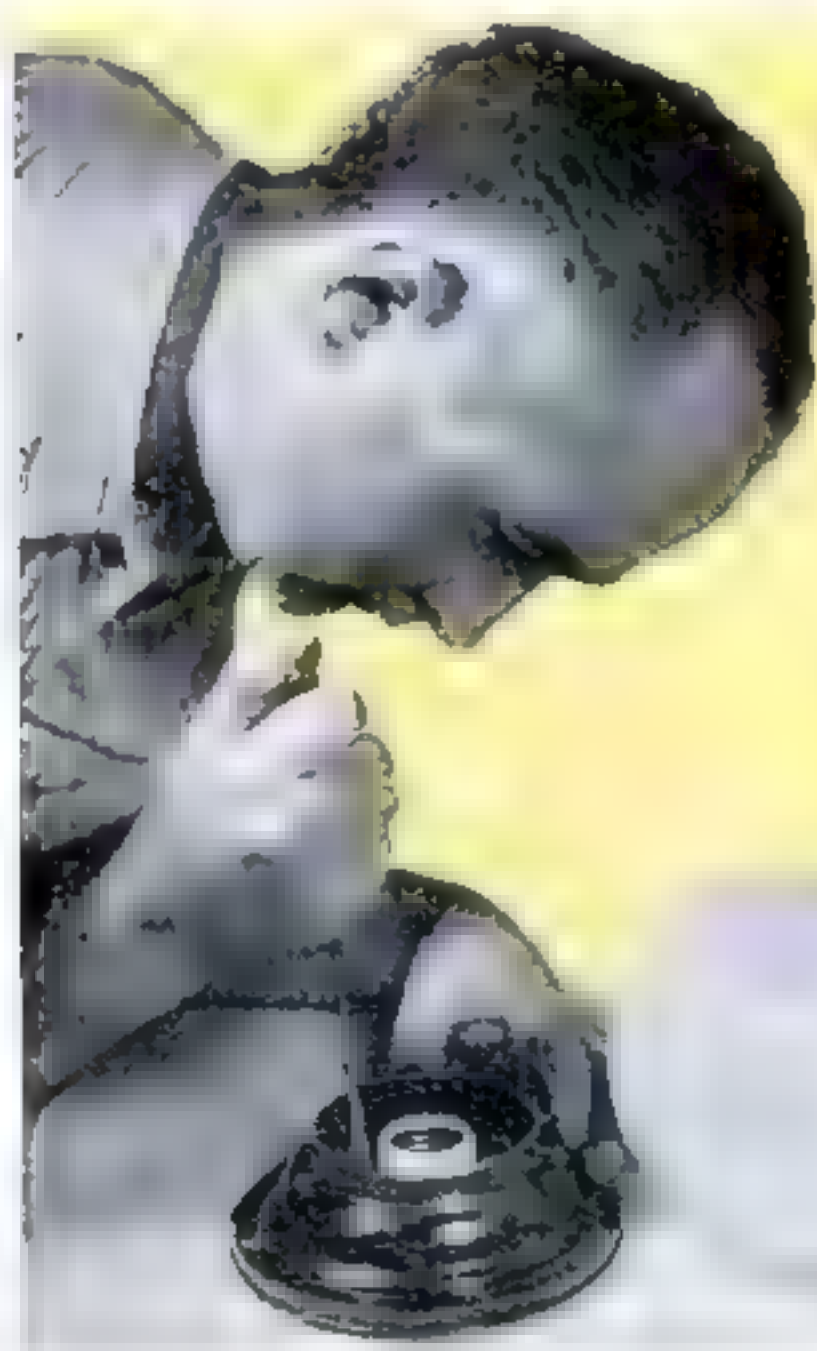
## Novel Radio Lamp Looks Like Planet Saturn

RESEMBLING the planet Saturn, this lamp provides an unusual and attractive bit of illumination for radio cabinet or center table.

The globe is a so-called 3 1/4 by 6-in. white glass ball, which you can get at an electrical supply shop, together with a brass ceiling fixture and an ordinary porcelain socket. Screw the latter to the center of a plywood disk fitting snugly into the base of the ceiling fix-

ture, which is used in an inverted position. In order to provide the markings seen on most planets when they are viewed through a telescope, a large sheet of white tissue paper may be slightly crumpled and thrust inside the glass ball. A plain frosted bulb of about 30 watts is recommended, although the lamp makes an effective night light with a 7 1/2-watt bulb.

The Saturn "ring" is a disk of brass, aluminum, or stainless steel, of 10-in. diameter and with a 5 3/8-in. disk cut from the center. Least expensive to use is the bottom of a ten-cent aluminum cake pan. The "ring" is most ornamental when in a slightly tilted position, but if desired, it can be moved about like any small shade that springs over the light bulb.



The lamp is really a ceiling fixture with a white glass globe. The porcelain socket is screwed to a plywood disk, which fits inside the fixture



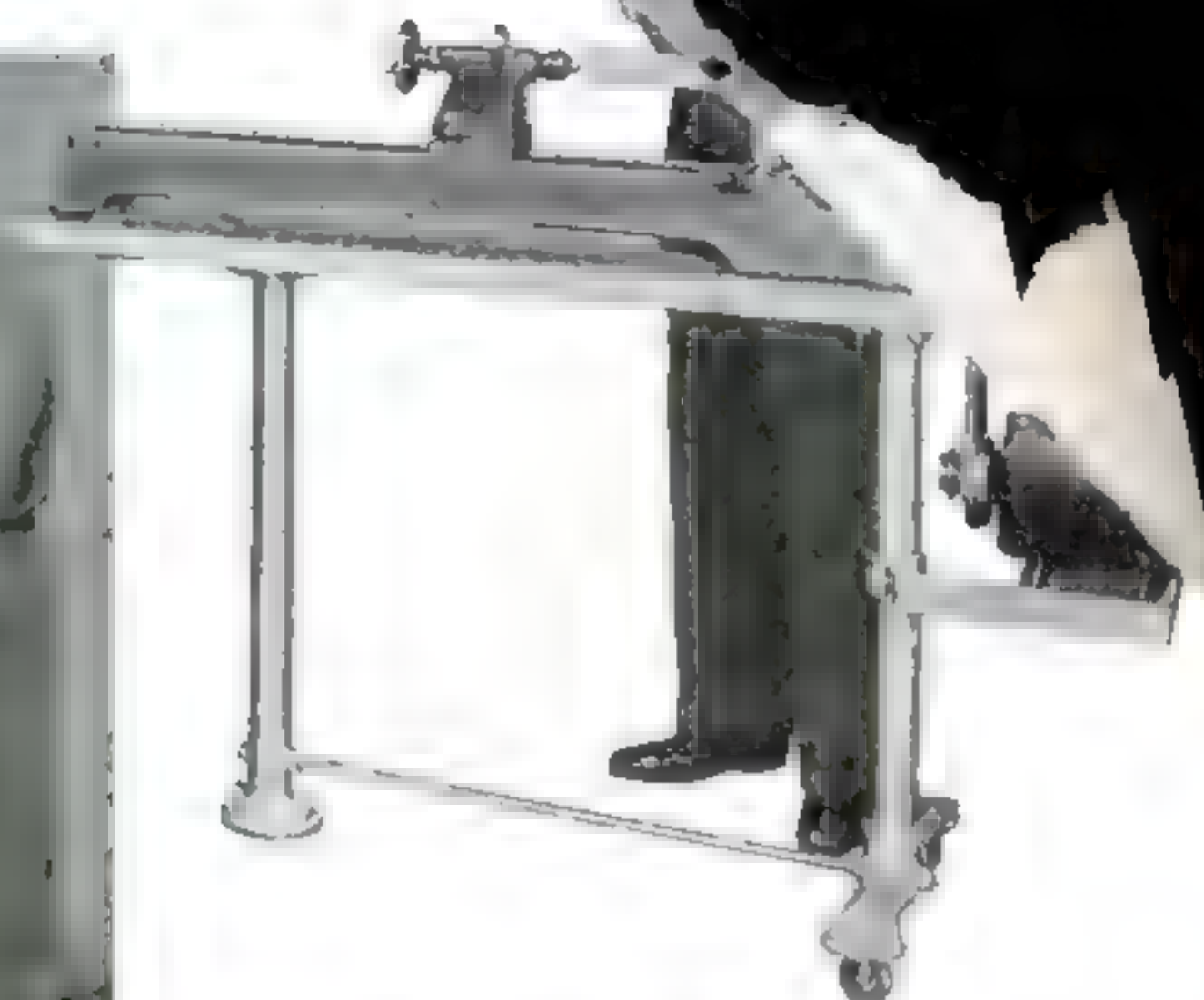
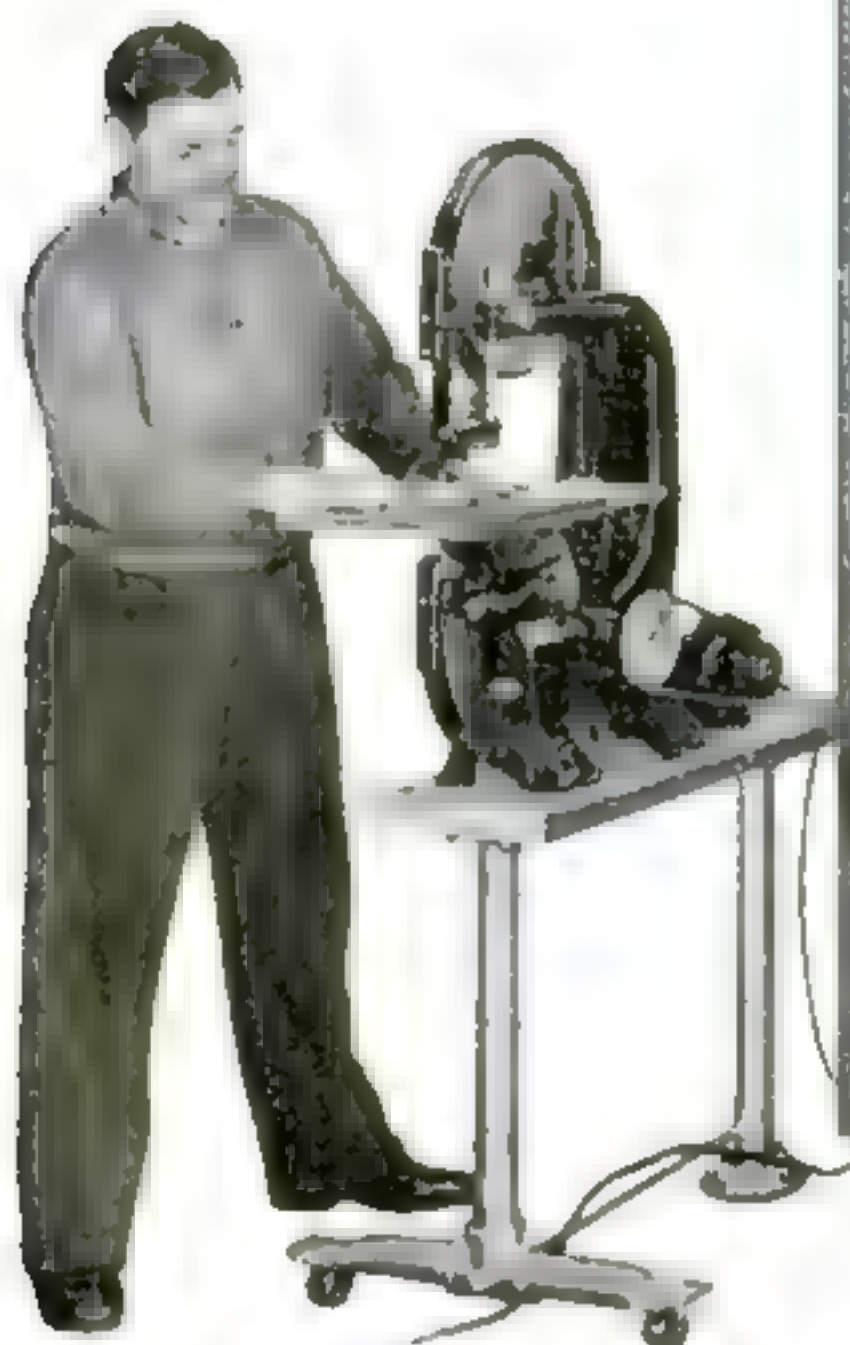
The metal ring, cut to fit the globe, is rubbed to a satin finish with medium-grade steel wool



# Many New Workshops

## STARTED BY GUILD CLUBS

Equipment in the workshop of the Staley Handicraft Club, Decatur, Ill., is on casters so that it can be moved about



shops report that there is a great increase in interest. Many members, having learned how to use power equipment, are now installing machines in their own home workshops. Of course, some club shops are small, but in every case the members plan to add to the equipment.

Approximately \$350,000 was spent by Guild members for new tools and supplies during 1937. Since only a small percentage of the home workshop enthusiasts who read *POPULAR SCIENCE MONTHLY* belong to Guild clubs, the total amount spent by all readers must have run into millions.

In 1936 the average club had 23 members; in 1937, 25 members. The average age of the members is 32 years. Nearly three quarters of the clubs have libraries containing magazines, books, and plans.

Annual club reports show that fifty-four percent of the clubs have received coöperation from hardware dealers in the form of *(Continued on page 98)*

**O**NE in every four clubs affiliated with the National Homeworkshop Guild now has its own workshop. Two years ago there was hardly a club shop in the country. Almost overnight they have sprung up—an answer to a keenly felt need for a central meeting place where processes could be adequately demonstrated, where members could work together on group projects, and where all could share the use of a wide variety of tools.

This healthy growth promises to continue steadily. Secretaries of clubs that have

### WHAT CLUBS ARE DOING TO AID THEIR COMMUNITIES

**G**UILD clubs are always willing to extend a helping hand in their communities and during the past twelve months have undertaken many unusual activities. A few of them are listed below.

Gave picnic for crippled children—Lambert Homecraft Association, Chicago, Ill.

Repaired furniture for persons who could not afford new pieces—Hardwood Homeworkshop Club, Neenah, Wisc.

Sponsored a junior hobby club—Buffalo (N.Y.) Homeworkshop Club.

Made game tables for local

Y.M.C.A.—Oneonta (N.Y.) Homeworkshop Club.

Conducted annual auction of articles made by members to raise money for clothing for poor children—Jacksonville (Fla.) Homeworkshop Club.

Built hat-and-coat racks for rural schools—Mandan (N. Dak.) Handicraft Club.

Made bookcases for local library—Wood-Ridge (N.J.) Homeworkshop Club.

Sponsored Boy Scout troops—Brookhaven Homeworkshop Club, Chester, Pa., and Domestic and Juvenile Court Officers' Club, Toledo, Ohio.



By means of mass production, the Lakeside Homeworkshop Club of Muskegon, Mich., was able to build 750 animal toys and pushmobiles. These were turned over to the Goodfellows Club for distribution among the city's underprivileged



REALISTIC

# Snakes

BRAIDED FROM LEATHER

By  
**HARRY  
STEVENS**

**Y**OU can pose as an amateur snake charmer and give your friends some unexpected thrills by making a snake of braided leather as shown in the accompanying illustrations. Coiled as if about to strike, it is surprisingly realistic, and its novelty always evokes admiration for your ingenuity and leather craftsmanship. The work itself is not difficult, once the method is understood.

Soft, pliable leather is the most practical for this purpose. I find the buckskin from a certain tannery in Fredericksburg, Texas, is the best stock of all that I have tried, but you can use whatever leather is available.

The snake illustrated in the large view above is made from black and white buckskin. The material needed for one like it is as follows: Four body strips or strings each 20 in. long, two of them (one white and one black) being  $\frac{3}{8}$  in. wide throughout, the other two being  $\frac{3}{8}$  in. wide for 16 in. and double that width, or  $\frac{1}{2}$  in., for the remaining 4 in. Two black filler or what are customarily referred to as "gut" strings, each  $\frac{3}{8}$  in. wide and 16 in. long. One tan string for a tongue,  $\frac{1}{4}$  in. wide and 5 in. long. One 20-in. length of fine copper wire.

With the copper wire, lace the two gut strings together full length and insert the tan tongue string, as shown in the drawing below. Then lace 3 in. of the remaining 4 in. of the wire through the tongue string. This gives you a gut-and-tongue string laced on the wire, with about 1 in. of the wire and 2 in. of the tongue string unlaced.

Now split the wide ends of the two body strings so that you have four body strings with six head ends. Tie the head ends to a nail or hook in the wall and begin making the body of the reptile by braiding the four body strings

around the gut string, starting 4 in. below the head ends and also 4 in. below the wire end. Pull the four strings tightly as you braid, and continue the entire length of the snake except for the last  $\frac{1}{2}$  in. Braid back these  $\frac{1}{2}$ -in. ends into the tail by tucking the ends back through the folds of the braid.

Then reverse the position of the snake by tying the tail to the nail or hook. Form the head by braiding three of the head strings for the upper jaw, and the remaining three around the folded end of the wire for the lower jaw. The tan string extends between the upper and lower jaws for a tongue, which is adjusted for length by cutting. The ends of the upper and lower jaws are finished by braiding back, the same as for the tail end. Yellow- or green-headed pins are added for eyes.

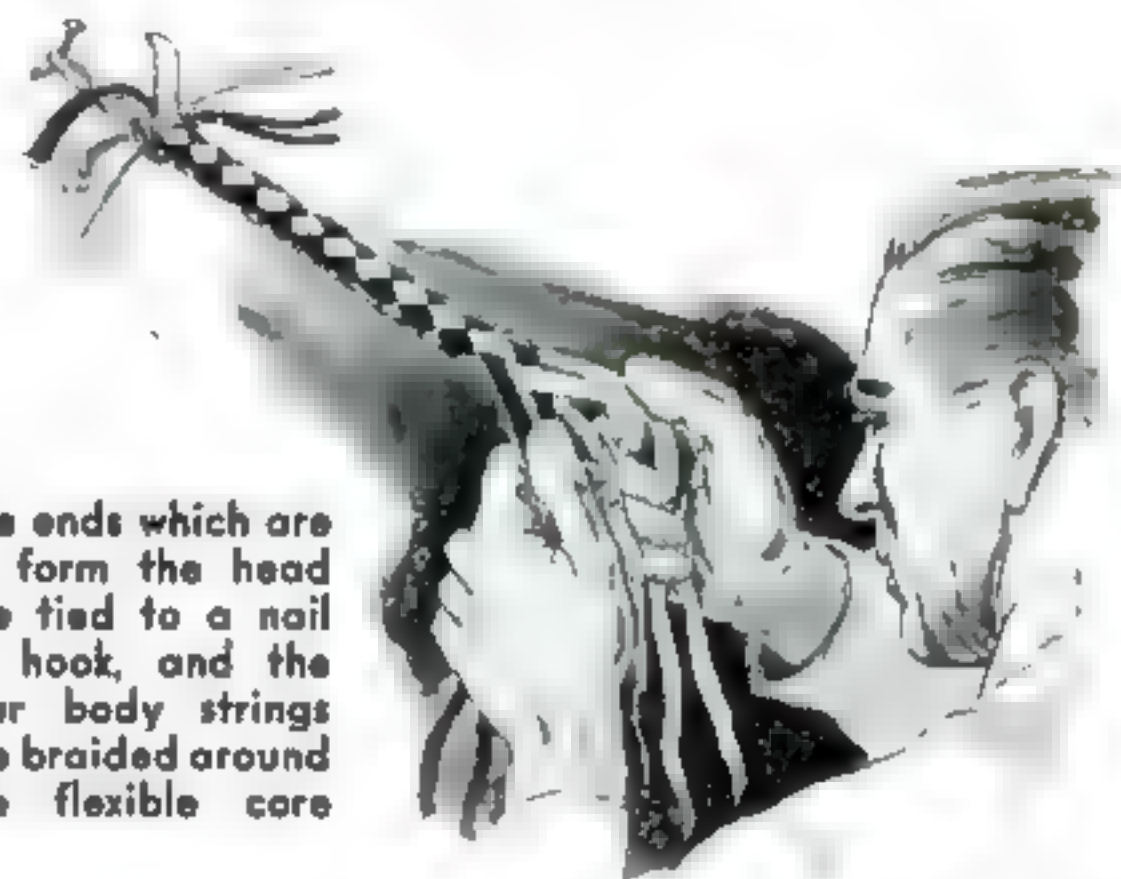
The copper wire running the full length of the reptile makes it possible to have the tail stand erect, as well as to give the striking position that live snakes take when startled or aroused. Like the living reptile, your snake will always be ready to fight.

It is quite possible, of course, to make miniature snakes and coil them for use as bracelets, leather buttons, or other novelties.

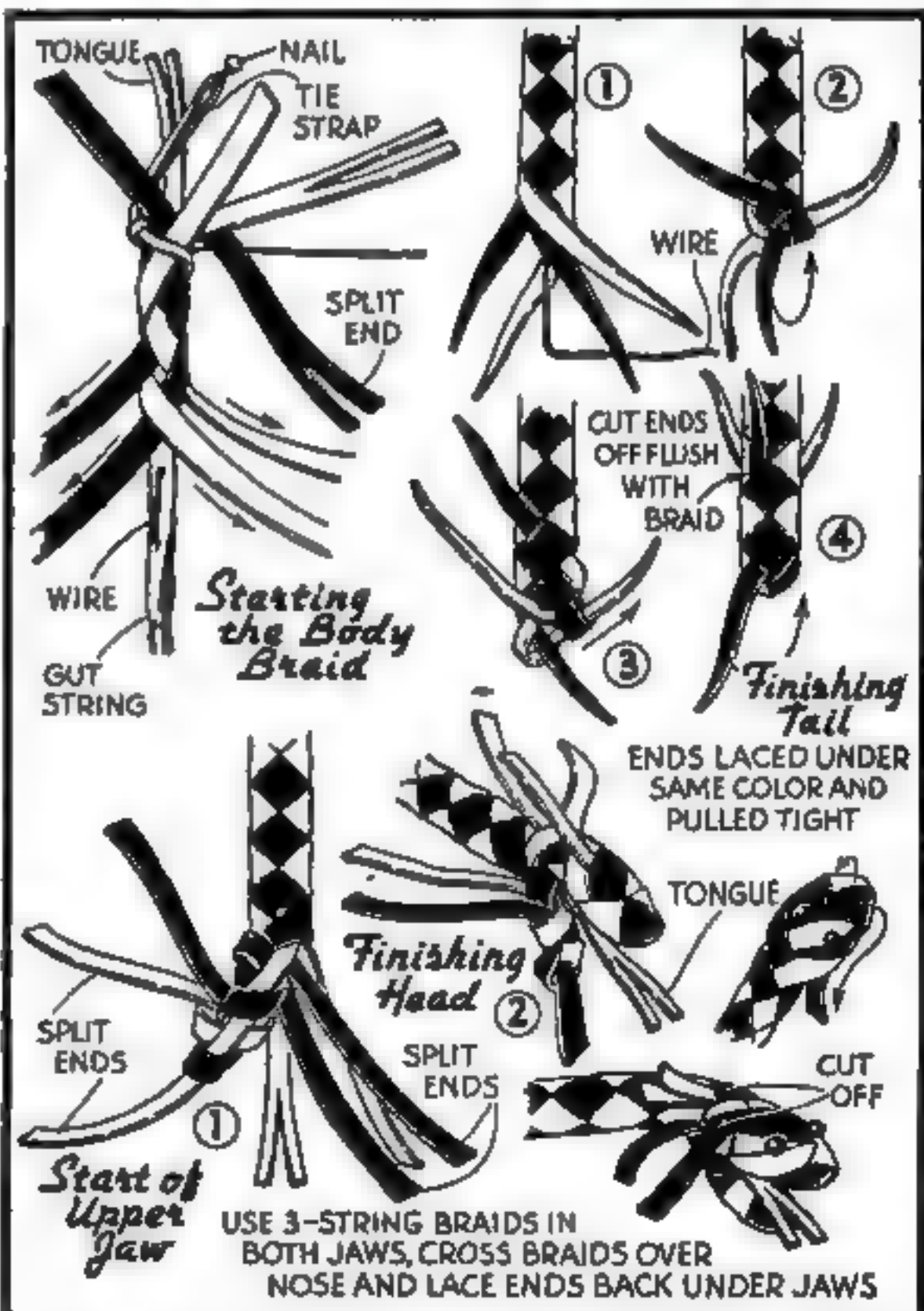
*If you enjoy leather work of this type and would like other articles to be prepared and published in future issues, please send a post card to the Home Workshop Department.*



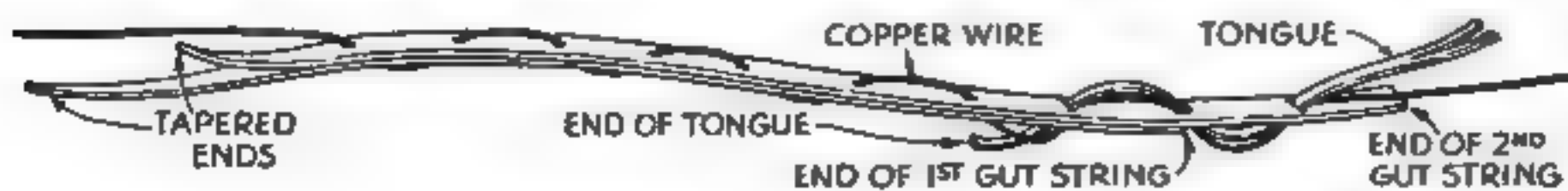
A wire running the length of the snakes makes it easy to coil them in lifelike attitudes, as if about to strike



The ends which are to form the head are tied to a nail or hook, and the four body strings are braided around the flexible core



How the body braid is started, steps in finishing the tail, and details of the head. Left, the core

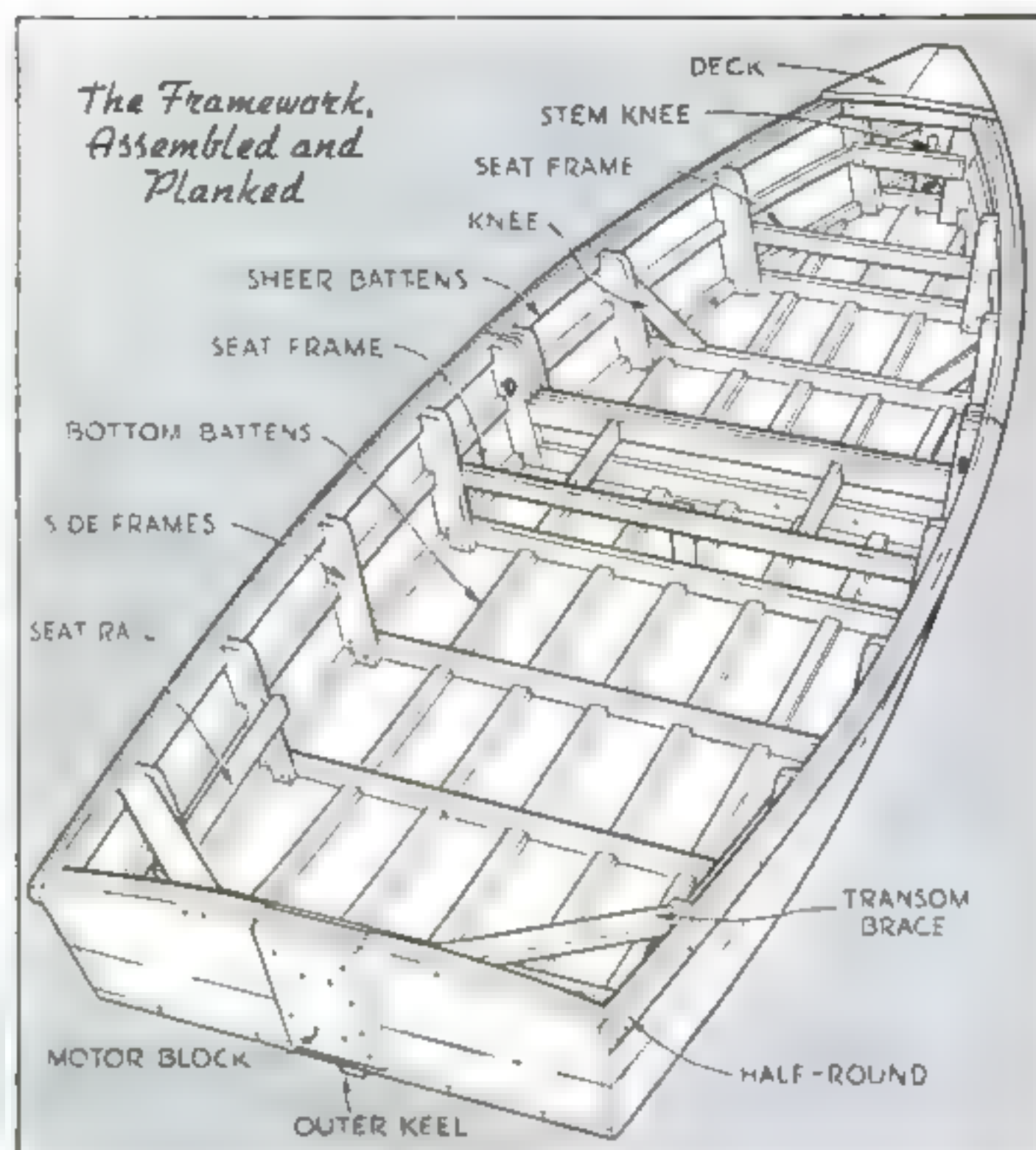




**WILLARD CRANDALL tells  
how to plank and finish our new**

# Portable

First planks to be applied are the lower sides ones, which may each be put on in one piece and sowed later where the sections join. The stem, transom, bulkheads, chine, and all frames must be trued and beveled



Interior without the seats or floor boards. For extremely light weight, the outside keel and motor block can be omitted

The forward section is removed by unfastening two thumb screws. It is then placed compactly inside the aft section as shown below



The bottom of the aft or larger section should be planked first. It is then removed from the keel form before the forward section is planked. Any protruding planks on both sections are sawed off and planed down at transom, bulkheads, and stem

**A**MONG the many advantages of the new all-wood sectional boat described last month (P.S.M., Apr. '38, p. 69) is the fact that it is comparatively easy to apply the planking to the framework provided the frame is carefully beveled and trued up after the battens are in position.

Start with the lower side planks. They should be dressed down flush with the chine so that the bottom planking will lap over them. The seams between the bottom planks should be left open about 1/16 in. to allow for swelling.

Just before screwing down each plank, coat with marine glue the battens, chines, transom, bulkheads, stem, and all joints that must be waterproof. Then lay a strip of cotton flannelette over the joint and coat the cloth with glue. White lead may be substituted for marine glue if desired. The planks should be fastened with flathead brass, galvanized, or cadmium-plated screws as follows: (1) Into transom, transom frame, bulkhead frames, and stem, 1-in. No. 6, spaced not over 1 in. apart; (2) into frames, 1-in. No. 6, spaced 2 or 3 in. apart; (3) into battens, chines, and keel, 3/4-in. No. 6, spaced 2 or 3 in. apart. To fasten a plank, first clamp it in place, then drill for the screws with a depth stop on the drill, and finally countersink enough to



# 'COME-APART' Boat

allow for covering with putty or seam composition.

The bottom of the aft section should be planked first and removed from the keel form before the forward section is planked. Once planked, the forward section can also be removed from the form, and the protruding planks on both sections sawed off and planed down flush at the transom, bulkheads, and stem.

Then fasten the two sections together with the two 3 by  $\frac{3}{8}$ -in. machine bolts, as shown in the drawings and, placing the boat on horses, put on the topside planks. The side frames will have to be temporarily forced apart until the seats and knees can be put in place. Fewer screws and no marine glue or cotton are necessary in fastening the planks to the sheer batten.

Dress the planking down at the bow so that the outer stem will fit over it. This joint should be coated with marine glue and cotton flannel-ette, and the outer stem screwed to the inner stem with 1-in. No. 8 screws.

The entire inside of the hull should be given at least one coat of paint before work is started on the deck and seats.

Make the deck from left-over planking material—screwed to the deck frame and sheer battens. Transom braces, made from the same material as the frames, should be placed as shown and fastened to the transom frame and side frames with 2-in. No. 10 screws.

Make the rowing seat

and bow seat from  $\frac{1}{2}$ -in. material and fasten to a special framework as indicated in the drawings. The center of the bow seat can be made removable, thus providing access to a stowage space. The rear seat is simply a  $\frac{3}{4}$  by 8-in. piece which rests on seat rails.

Knees on frame No. 3 are necessary to hold the sides in a true curve. The outside keels are screwed through to the inside keels, using  $1\frac{1}{4}$ -in. No. 7 screws. Then screw the oarlocks to the sheer batten with  $1\frac{1}{4}$ -in. No. 10 screws. Clamp and screw the half-round sheer molding to the planking and sheer bat-

ten with  $1\frac{1}{4}$ -in. No. 7 oval-head screws.

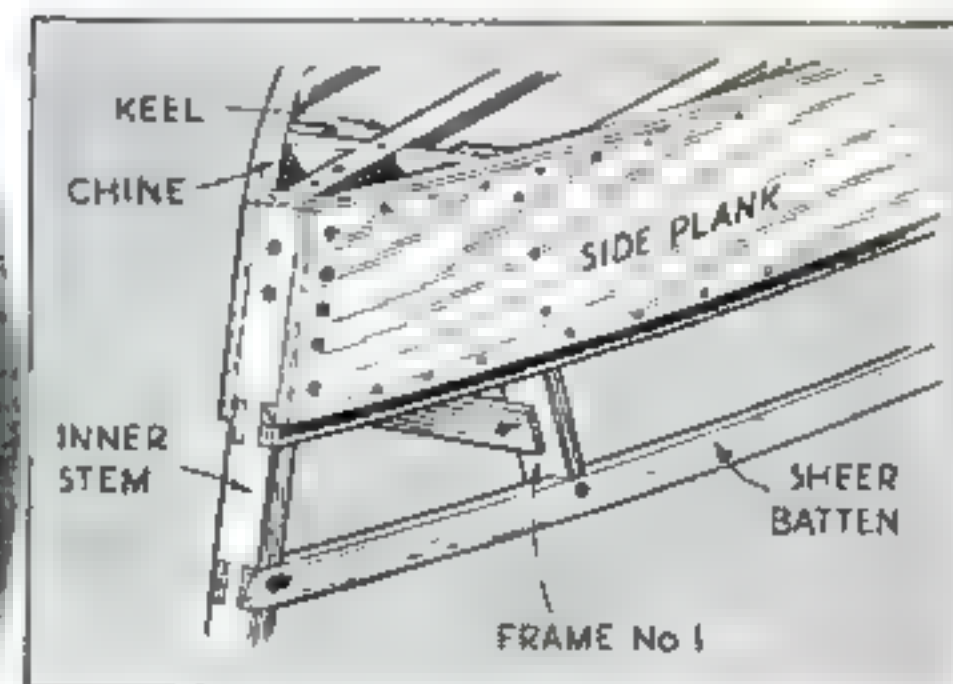
Sand the outside well and give the hull two coats of paint. Finish with marine enamel or with flat paint followed by a coat of spar varnish.



Floor boards are fastened with only a few screws. The center of the bow seat can be made removable, providing access to the stowage



The side frames have to be temporarily forced apart so they will be held until the seats and knees can be put in place



Above, sketch showing how the bottom side planks are fastened. Left, the half-round molding should be clamped in place before it is finally fastened



## New Game Flips Disk When Lever Is Pressed

IN PLAYING this entertaining game, a small red cardboard disk is placed in a hole in the game board, where it rests on a piece of thin metal. The lever projecting from one side is then pressed. This flips the cardboard disk nearly a foot into the air with a sharp pop.

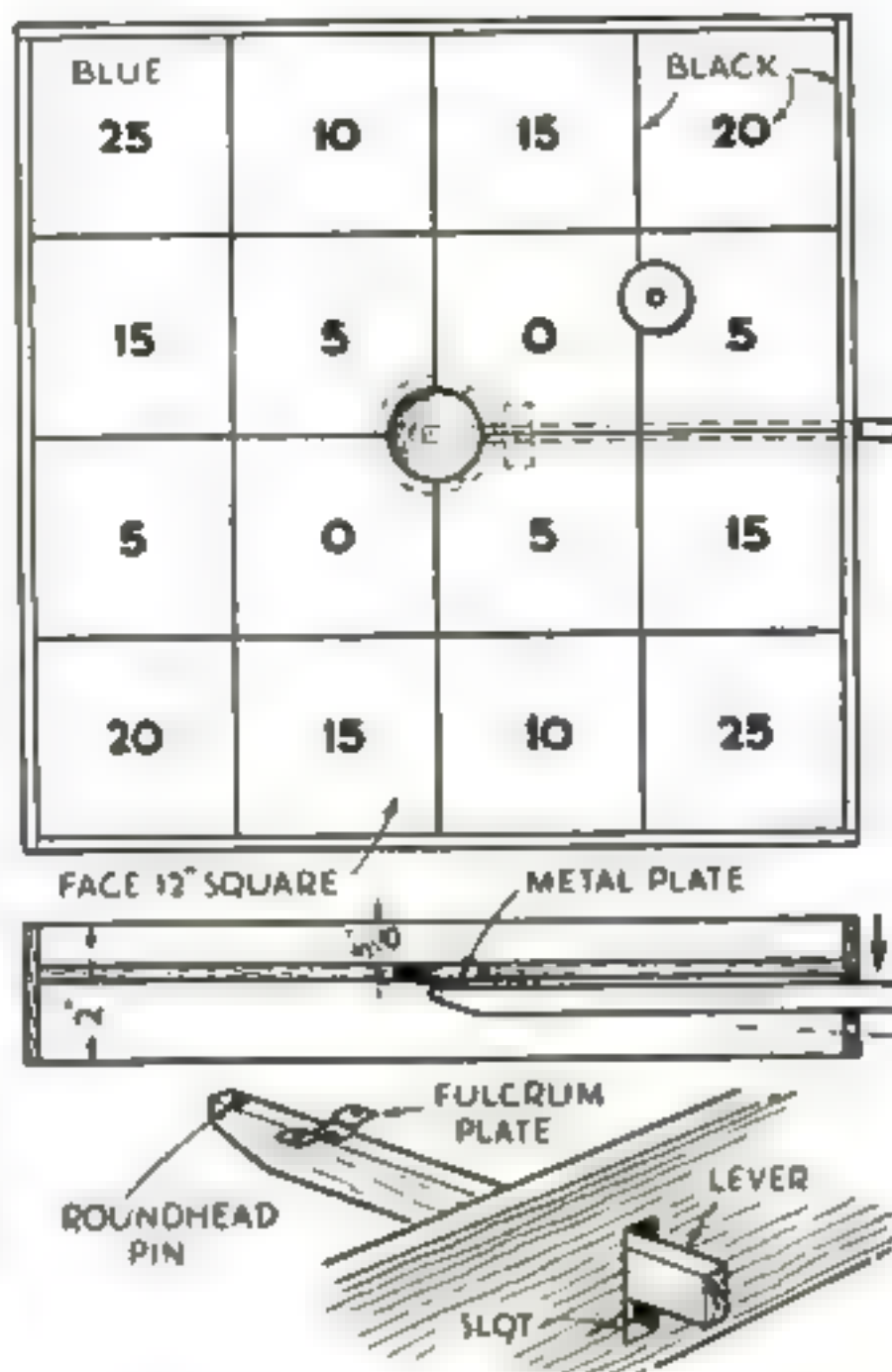
The score made by each play depends upon the number of the square in which the disk lands. If it falls in such a way that the central hole in the disk is over a line, so that the line can be seen through it, the play does not count, and an extra turn is allowed. Should the disk fall back into the hole, no score is made. To reset the metal plate, take hand off the lever and press down center of plate with a finger.

Only nine simple parts are required.



Players take turns popping the disk and score according to the square on which it falls

In attaching the metal plate under the  $1\frac{1}{2}$ -in. hole in the board, make the holes in the plate oversize and leave play under the nailheads. Similarly, in fastening the fulcrum plate, do not screw it tightly to the lever. Make the final adjustments by hammering down the center part of the plate until it flips the cardboard disk into the air properly.—DONALD W. CLARK.



## Heavy Steel Clamp Acts as Emergency Wrench

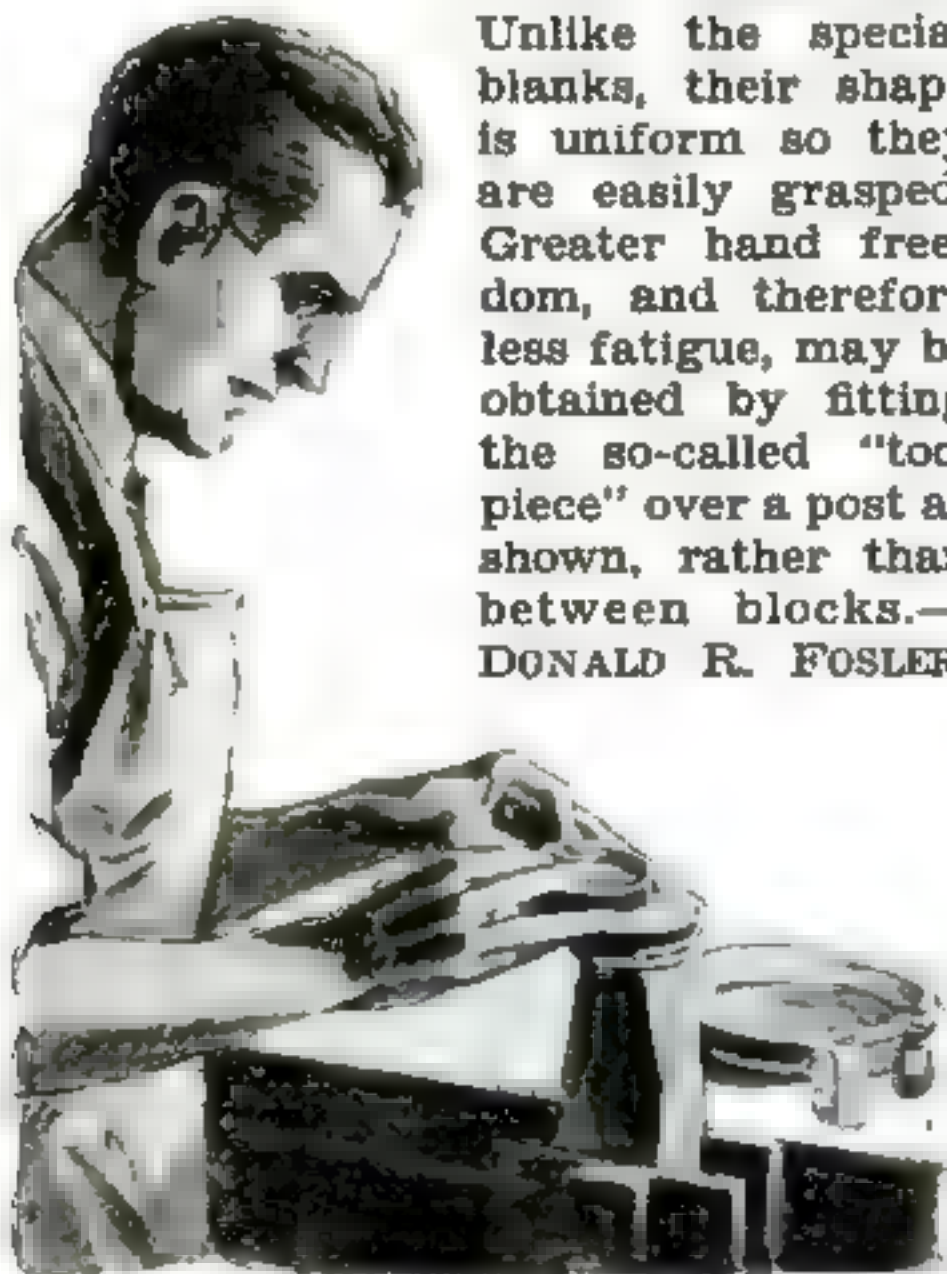
WHEN tightening or loosening large pipe fittings or machine parts, a mechanic often discovers that he does not have a wrench of sufficient size to fit the work. A heavy steel clamp makes a good substitute in such instances. Fasten the clamp in position, leaving enough space so that a rod or bar can be slipped through, as illustrated above. The rod serves as a handle and gives suitable turning leverage.—O.R.S.



## Glass Caster Cup Used for Telescope Mirror

AFTER I had paid a good price for poorly made glass blanks to make small reflecting telescopes, I discovered that ordinary large size (4-in.) glass caster cups were more practical and less expensive. They are usually priced

at ten cents each. Unlike the special blanks, their shape is uniform so they are easily grasped. Greater hand freedom, and therefore less fatigue, may be obtained by fitting the so-called "tool piece" over a post as shown, rather than between blocks.—DONALD R. FOSLER.



By mounting the "tool piece" over a post, the grinding is accomplished more easily

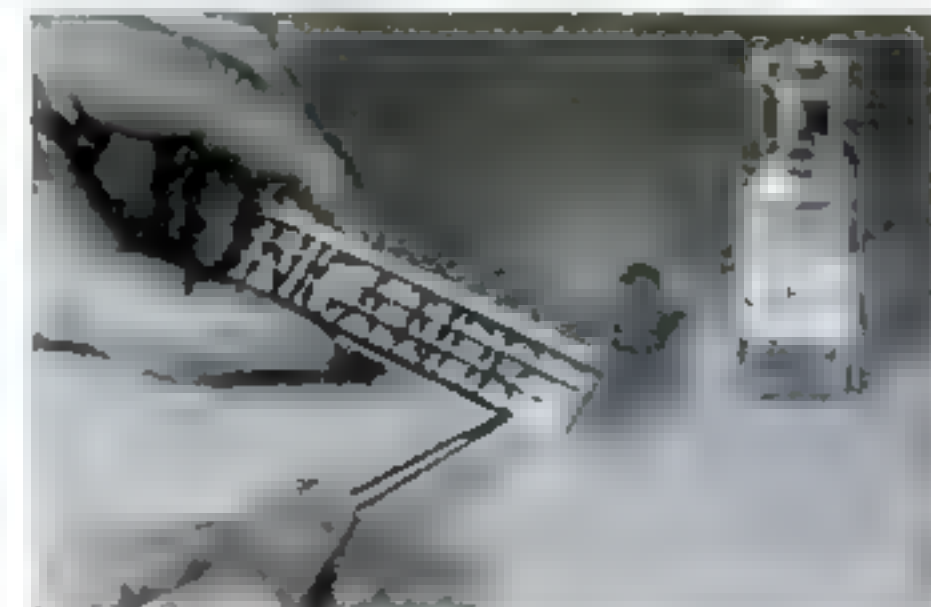


The zinc seam binding is cut into lengths of about 3 in. and lettered with a special ink. A galvanized-wire leg is added to each by crimping it around as illustrated below

## Durable Plant Labels Cut from Linoleum Seam-Binding Strips

INEXPENSIVE and permanent garden labels for marking seed beds and garden plants can be quickly made by cutting off 3-in. lengths of the zinc seam binding that is used in laying linoleum. The ink for writing on the zinc is a solution of copper sulphate or bluestone. It can be prepared in practically any strength, but should be fortified with about half a spoonful of muriatic acid to several ounces of the solution in order to give a better "bite."

Apply the writing solution on the metal slips with a small water-color brush. A stiff piece of galvanized wire is bent at one end and crimped onto each label as shown with pliers to provide a leg for sticking in the ground.



For lettering, a solution of copper sulphate fortified with muriatic acid is used

These labels are waterproof. The name can be erased for reuse by heavy sandpapering, or the reverse side can be written on.—R. W.



# GUNS FOR THE 'ALABAMA' Model

By Capt. E. Armitage McCann

**A**RMING our *Alabama* model\* is the interesting task ahead of us this month. Although she captured many vessels without firing a shot, it was the threat of her guns that made the famous Confederate commerce raider the scourge of the seas for two years during the Civil War and enabled her to capture nearly seventy Federal vessels.

There are still some details of the deck to be added, so it will be just as well to get these out of the way before making the guns. In this work, refer to the deck plan published last month.

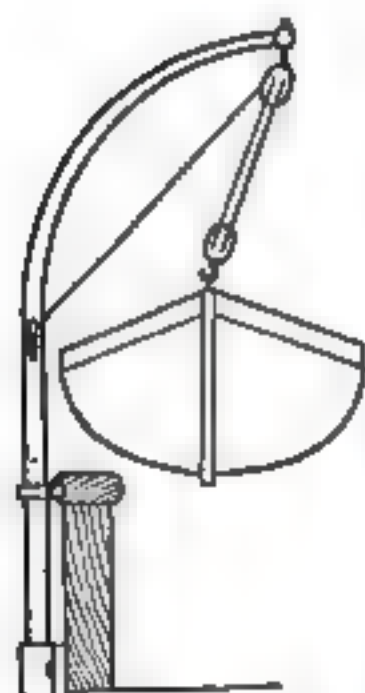
The hatches are frames of  $\frac{1}{8}$ -in. wood, rabbeted to take the grating. They are black, with teakwood-colored gratings.

The propeller hatch (see drawing, P.S.M., Mar. '38, p. 88) is similar to the others in general construction, but covered with a solid piece, divided in two lengthwise and with a hole for the chain to pass through.

On the poop there probably was a skylight. This I made to represent six triangular glasses with dividing bars.

There are two steering wheels joined to a barrel for the wheel chain and set on iron standards. The wheels should be  $\frac{1}{2}$  in. in outside diameter and as thin as possible. The standards can be cut from fiber board or metal, and the legs sunk into the deck. A small chain is wound a couple of turns around the barrel, and the ends are stuck into holes in the deck.

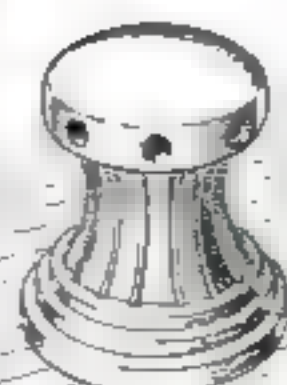
\*This is the fourth in a series of articles on the construction of a scale model of the *Alabama*. See P.S.M., Feb. '38, p. 77, Mar., p. 88, and Apr., p. 83.



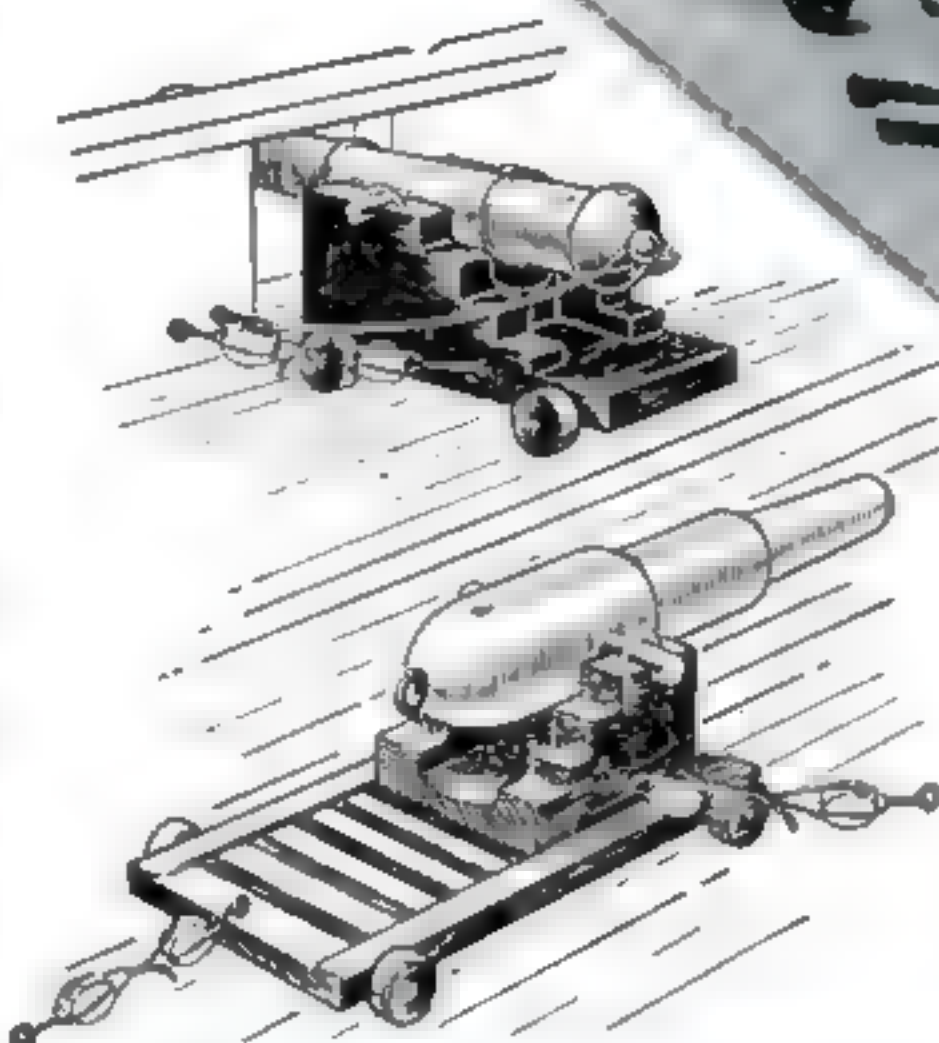
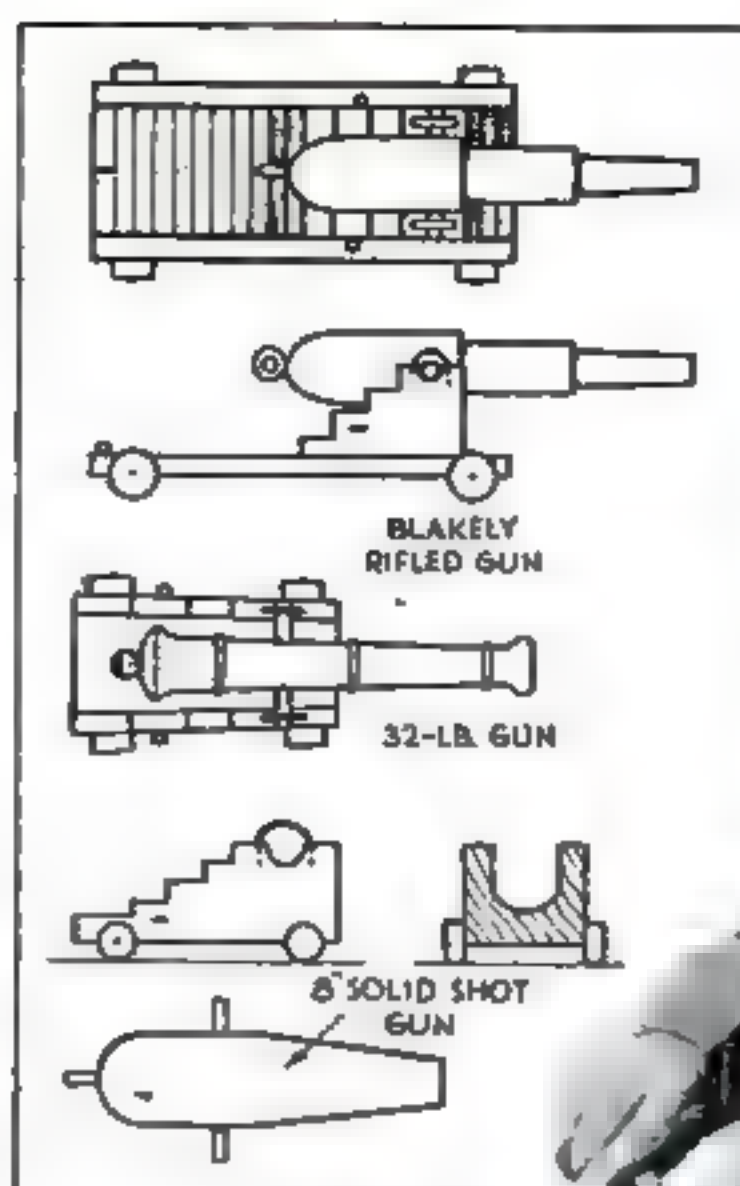
Full-size detail of boat davits. The ones at the stern, illustrated at right, are a trifle shorter



Bridge, funnel, and two of the boats hanging in davits. Below, the big capstan



The three types of guns appear full size above. The 8-in. gun has a carriage like the Blakely gun



How the model looks when completed. It is 28 in. long and 16 in. high over all

Between the assembled steering wheels and the adjacent hatch there is a compass binnacle. The top is filed from a piece of brass and set on a wooden base.

On the forecastle is a large capstan connected with the windless below. This is carved or turned in the usual way from a piece of wood.

The bell at the break of the forecastle (see drawing in the March issue, page 88) is about  $\frac{1}{8}$  in. high. I hung it on an ornamental bent-wire bracket, the ends of which are stuck in the deck.

Around this deck from cathead to cathead are stanchions and rails, and there are two ladders, all similar to those for the bridge. These were illustrated last month.

Iron bitts are set on either side of the forecastle deck. These are best bought ready-made or cast from white metal, but they can be built up from wood or metal, if preferred.

The poop deck has a teakwood rail around it, set on turned wooden stanchions. I jig-sawed the rail to shape in one piece from  $\frac{1}{16}$ -in. plywood, except across the front, where three straight pieces of the same material are required.

Ladders lead to this deck, and it has mooring bitts on each side. At each forward corner are pinrails set firmly  
(Continued on page 106)

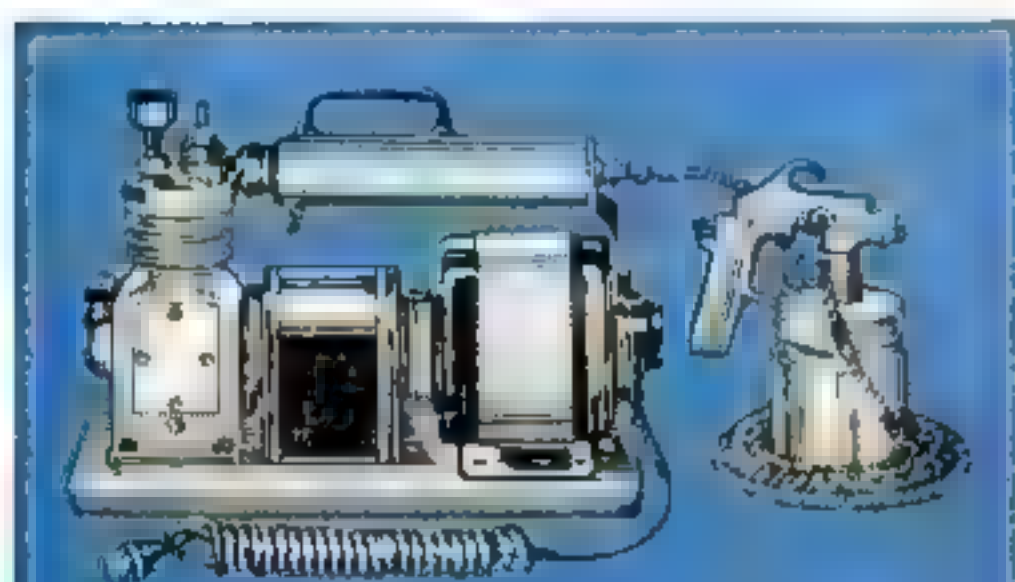




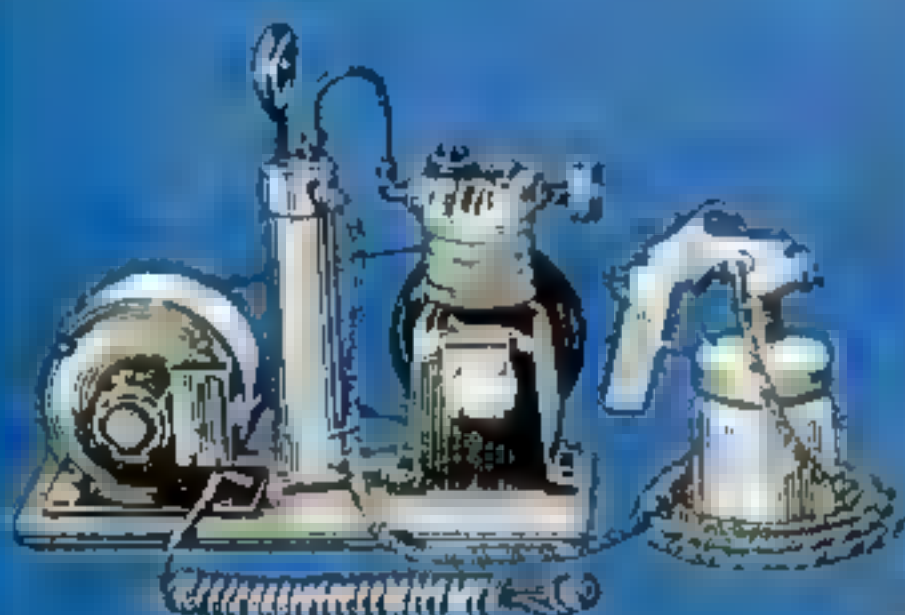
# Better SHOP Methods

## Choosing a Paint Sprayer

Efficient paint-spray equipment is shown at the right. Note the stands of various heights with interchangeable wire tops and the spray tables with tops to fit high or low bases



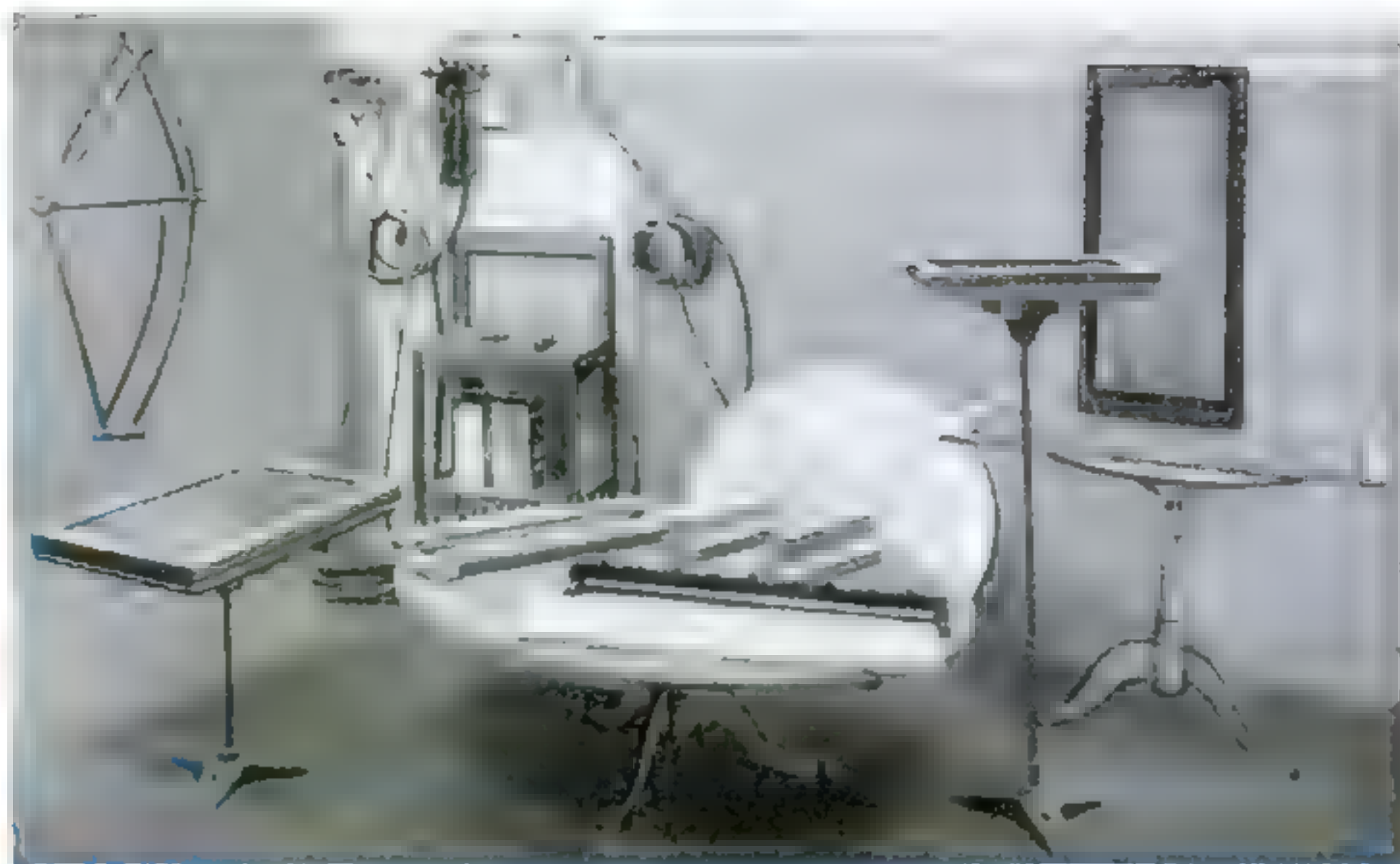
Direct drive portable spray outfit with a transformer and pressure regulator



A considerably less expensive outfit with V-belt drive. This is a type excellent for home workshops



Semicommercial unit for the garage and refinishing shop with 100-lb. air pressure



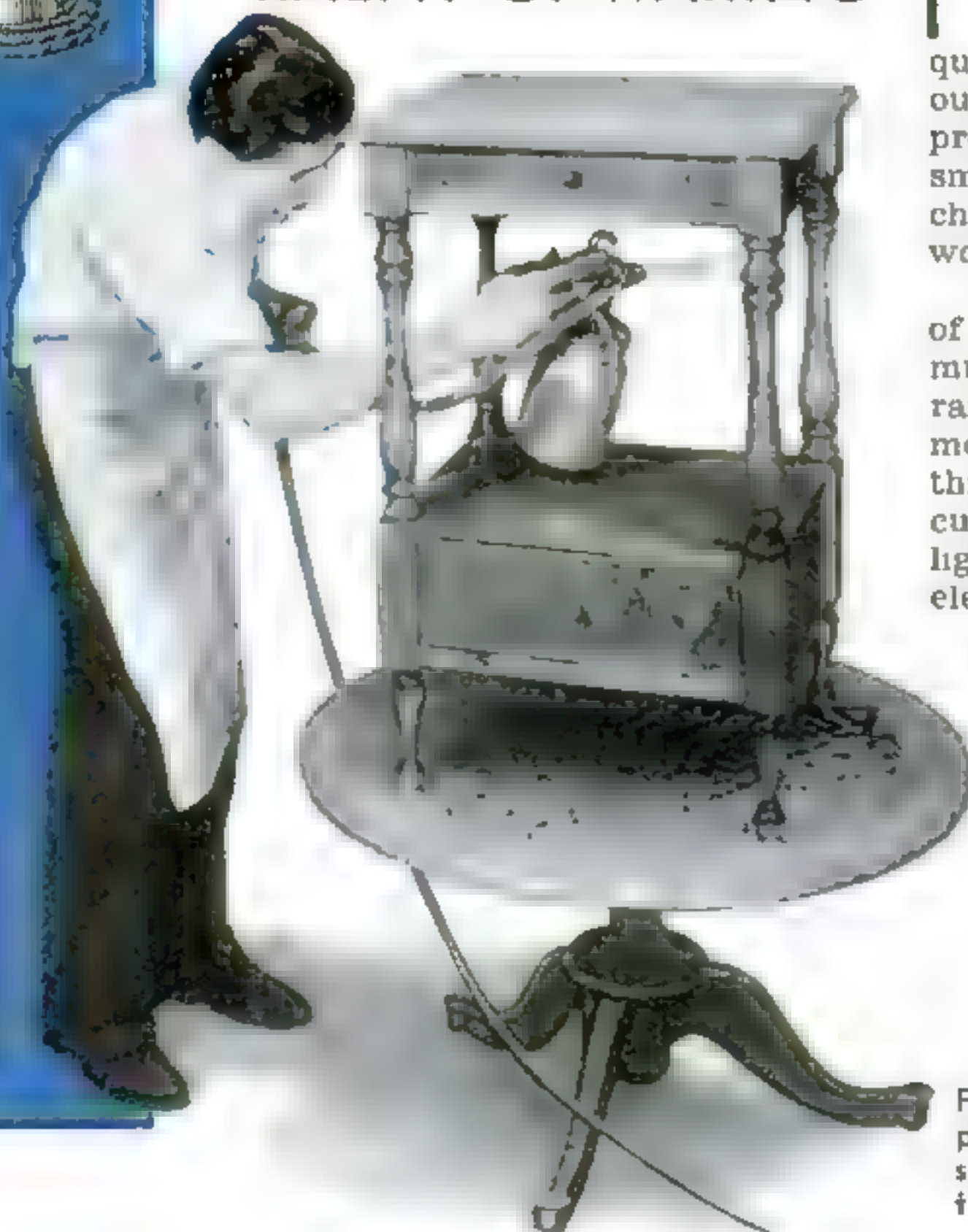
By  
RALPH G. WARING

**N**OW that furniture, automobiles, shop equipment, and household utilities are so generally finished with the spray gun, the question of installing a paint-spraying outfit is of increasing and often of very pressing importance to the owner of a small shop, as well as to amateur mechanics who have well-equipped home workshops.

A suitable space in which to work is, of course, the first requirement. It must be easily accessible and so arranged that the largest piece of equipment or furniture can be brought through adjacent doors without difficulty. It should have as much natural lighting as possible, together with good electrical service.

Some means of forced ventilation is desirable, either by installing a suction-type fan or by exhausting the fumes into a water spray and thence into the sewer. Rebuilt equipment or second-hand outfits for this purpose can be purchased at reasonable prices.

The spray booth itself should



Furniture and other fairly large pieces are set on a turntable for spraying. The inside and out-of-the-way parts are sprayed first



be about 6 ft. high, 8 ft. wide, and from 5 to 6 ft. deep, depending on circumstances. If most of the work is to be done in winter, some source of heat should be available for drying the finishes.

The man who does a good job of installing his spray booth and lines it either with sheet metal or with building board composition, coated with water glass for fireproofing after erection, will be better satisfied in the long run. In addition, he will be in a better position to take in outside work, if necessary, as a means of paying for the installation and equipment.

With the spray booth and attendant exhaust problem satisfied, we are next concerned with the spray machine itself. Remember that good spray equipment, properly taken care of, is a lifetime investment. By all means avoid the types that attach to a vacuum cleaner or to auto-engine cylinders in place of a spark plug; also those spray guns which have a motor and spray head in a one-piece assembly, as this design is too heavy and awkward to be practical except in the hands of a giant.

Three typical outfits are shown in accompanying drawings. The first is a direct-drive portable outfit, priced at about \$70. The second is a portable outfit with V-belt drive which is well adapted for the home workshop. It costs complete about \$40. The third is a semicommercial unit for garages or refinishing shops where air pressure at 100 lb. and from 8 to 10 cu. ft. per minute is available. It is standard equipment for lacquers and synthetic finishes.

Any equipment must have both an air transformer and a pressure regulator and gauge. The air transformer effectively strips oil and moisture from the compressed air and delivers it dry and clean to the gun. The pressure device enables the correct poundage to be used on the gun to suit the kind and viscosity of the material being sprayed.

The gun itself is of the utmost importance and should not be purchased from any but a first-class manufacturer, and then only when its requirements in relation to the compressor are clearly understood.

Some guns operate efficiently at 4.3 cu. ft. per minute and under 25 to 35 lb. pressure. Others require as many as 7.2 to 9.7 cu. ft. per minute at 55 to 65 lb. pressure, or even 100 lb. Obviously, it would not be wise to buy one of the lat-

ter at any price, no matter how small, if the compressor does not have a capacity over 6 cu. ft. per minute at 50 lb. pressure. Whenever possible, buy a complete unit as made by one manufacturer.

Again, an adequate gun should have suitable adjustments whereby the spray is changed from narrow to wide, and flat to round without any need of taking the gun apart. It should be light and small to facilitate quick manipulation on small areas or parts—not heavy and clumsy. It must be easily cleaned, oiled, and reassembled.

The handle or stock should be a solid forging, formed to fit the hand and free from corrosion when cleaned in standard solvents. Of equal importance is the design of the trigger and whether it is a one-, two- or three-finger control. If much work is to be done, this item has considerable bearing on hand fatigue. A small gun of 4- or 5-in. spray stroke will have but one finger control, but guns of greater width and cup capacity will vary.

When accessory equipment is considered, at least two 25-ft. lengths of braided air hose, complete with fittings, should be on hand. The air duster, a small, pistol-like device with a finger valve, is worth while for cleaning off work just previous to the application of any finish. It is far superior to the usual round, mule-hair duster, and as a matter of fact should be used with it.

For handling chairs, tables, dressers, and other large work, spray-booth turntables are a necessity. These should consist of heavy wooden or cast-iron bases, with a central bolt of adequate size on which the removable top can be dropped to turn freely without wobble. Those shown were made from obsolete drawing-table bases picked up in a junk yard. The 2 by 4-in. hardwood cleat, screwed flat under the top, was built up to about 4 in. in the center

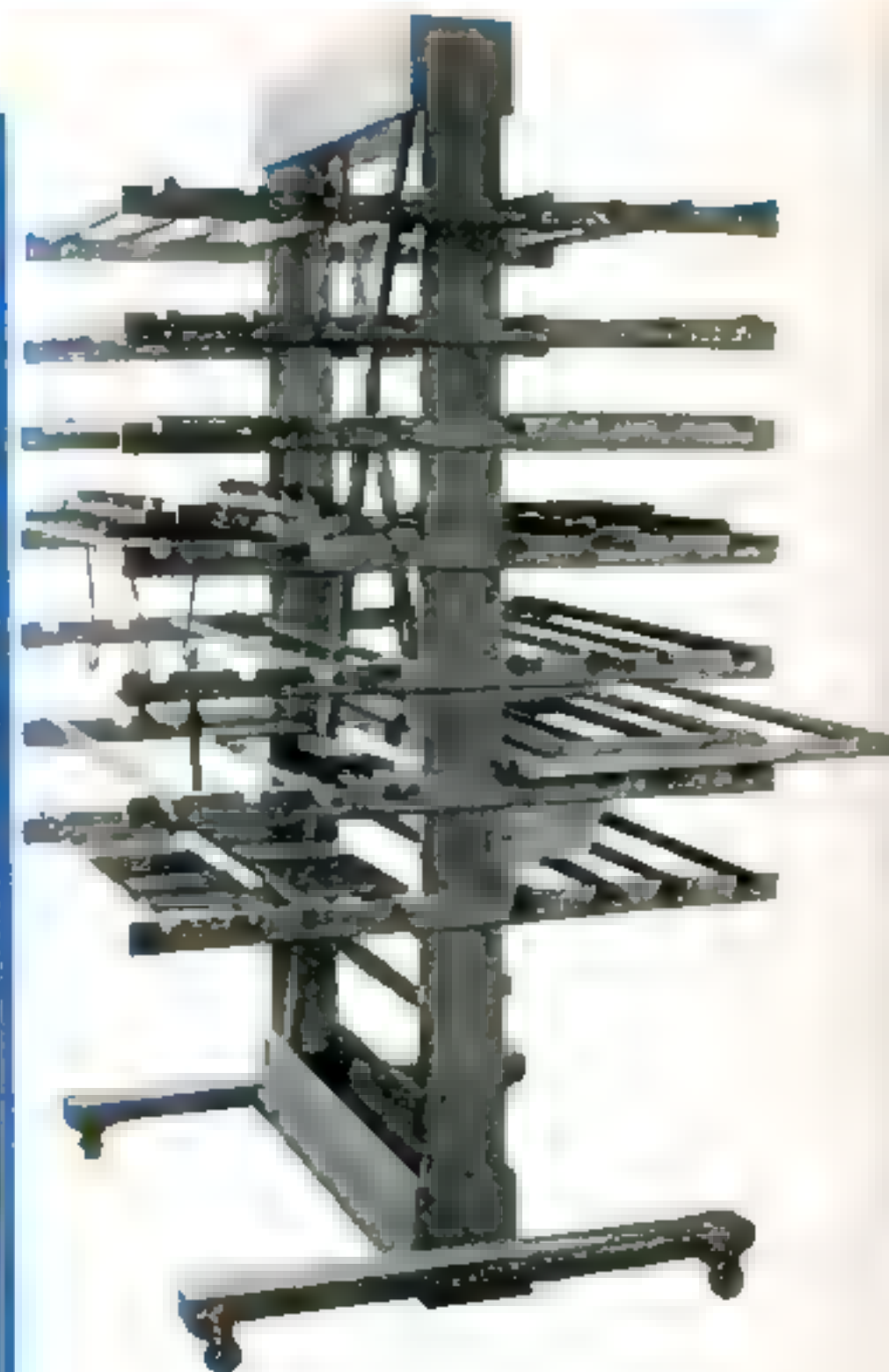
and then drilled to fit a  $\frac{3}{4}$ -in. piece of pipe bushing, which in turn gave an adequate fit on the  $\frac{3}{4}$ -in. bolt fastened to the base casting. The top of the table was covered with galvanized sheet iron to give long wear and to insure easy cleaning.

From time to time useful accessories will suggest themselves, especially tight-drawn wires and hooks for many small parts; a portable drying rack with variable slip rods to accommodate large and small panels; spray stands with  $\frac{1}{2}$ -in. wire cloth frame tops to facilitate clean, fast spraying of small parts, without rehandling until dry; boards with nails to elevate work above the spray table, and spray-table blocks with beveled top edges for heavy work.

In a following article, tricks of the trade, operations, and methods will be discussed in detail.



Spraying a frame on a wire topped stand



Portable spray rack designed to hold a large variety of work. Note that the arms are notched to receive the rods, which are loose and interchangeable



An air duster used to clean work prior to spray coating. It is far better than a mule-hair duster



Key to Diagram

- |                                 |                                 |
|---------------------------------|---------------------------------|
| 1 AIR CAP                       | 7 FLUID-NEEDLE PACKING          |
| 2 FLUID TIP                     | 8 TRIGGER                       |
| 3 RETAINING NUT                 | 9 BODY AND BARREL ASSEMBLY      |
| 4 SPREADER ADJUSTMENT VALVE     | 10 AIR-VALVE STEM               |
| 5 GASKET AND PORT-RING ASSEMBLY | 11 FLUID-NEEDLE ASSEMBLY        |
| 6 AIR VALVE                     | 12 FLUID-NEEDLE ADJUSTING SCREW |



# ATTACHMENTS FOR THE Oxyacetylene Cutting Torch

**W**HEN the oxyacetylene cutting torch is held free-hand, every heartbeat, breath and involuntary twitch is recorded in the cut, but this can be avoided by making the simple attachment illustrated at the right.

First, a bushing is required with an outside diameter  $\frac{1}{4}$  in. larger than the largest tip, and bored to fit the tip used for average work.

The next requirement is a yoke made from a piece of  $\frac{1}{2}$ -in. mild steel plate, bored to fit the outside of the bushing and with one side split and drilled so as to clamp the bushing in the yoke and at the same time hold it rigidly on the tip. The other side of the yoke has a boss left on, and this is drilled and tapped for a  $\frac{3}{8}$ -in. rod. In fact, we use several rods, ranging from 3 to 13 in. in length.

From a piece of shafting a pivot is turned, pointed at one end, and drilled to take the rod in the center. It is drilled and tapped at the other end for a set screw to hold it on the rod.

Finally, there is a two-wheeled dolly, the body of which is  $\frac{1}{2}$ -in. plate, drilled to take the rod and a set screw to hold it on the rod. The wheels are about  $1\frac{1}{4}$  in. in diameter,  $\frac{1}{2}$  in. thick at the hub, and tapered to almost a sharp edge at the rim. They revolve on  $\frac{3}{8}$ -in. studs.

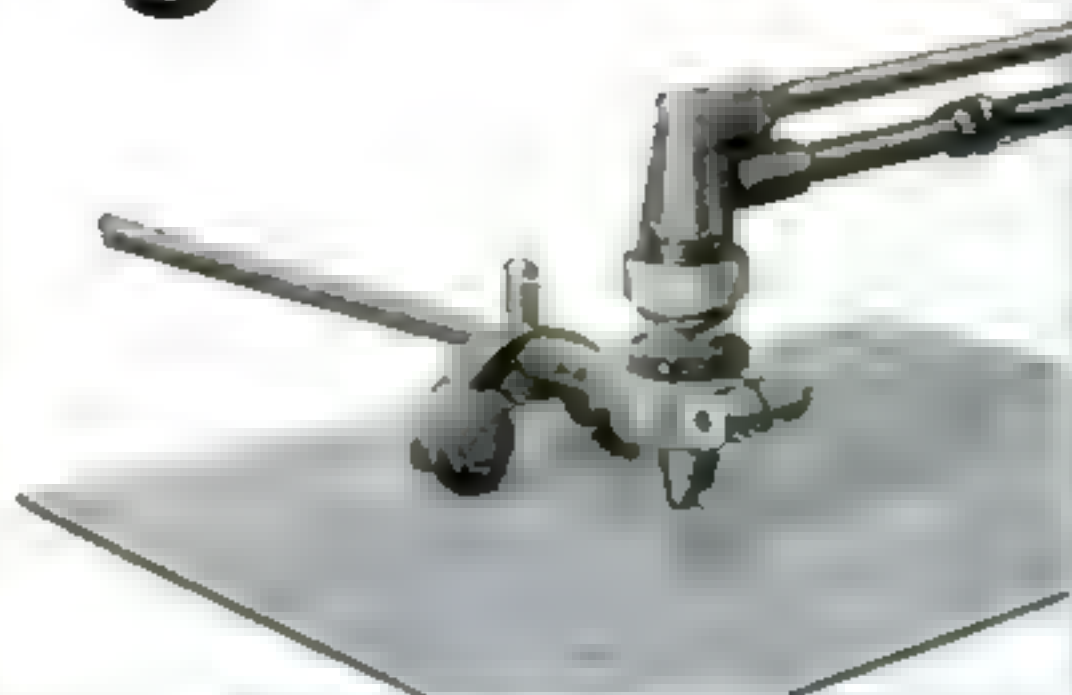
For cutting a circle, we place the bushing, yoke, and rod on the torch tip, and set the pivot on the rod so the distance from the center of the pivot to the inside edge of the cutting jet of the tip is equal to the required radius. All that is then necessary is to light the torch and cut the disk. If a large circle is needed, the dolly may be placed between the torch head and the pivot.

For following a straight or an irregular line, the dolly is placed on the rod and, if practical, a rod is used with sufficient weight to balance the torch head.

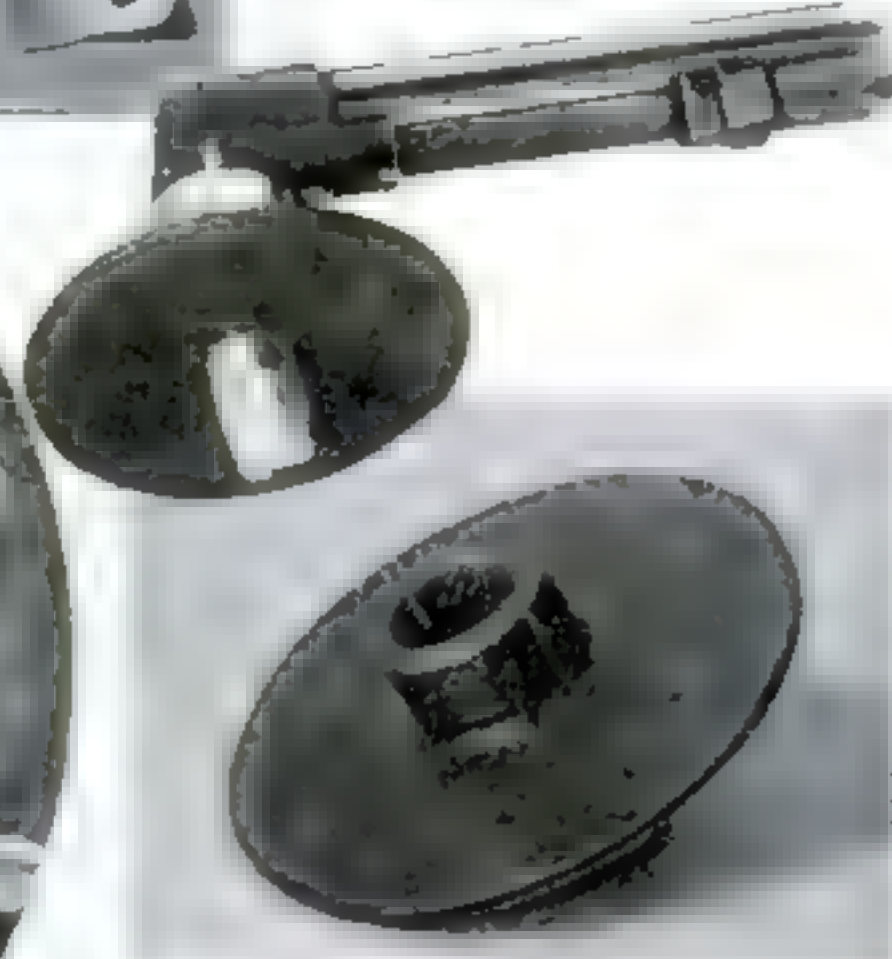
Another valuable accessory is a disk to protect the head of a cutting torch when used for punching holes or burning out rivets. This disk is made as shown from a piece of  $\frac{1}{8}$ -in. steel plate,  $2\frac{1}{2}$  in. in diameter. A piece of iron pipe

$\frac{1}{2}$  in. long is brazed on one side. The hole through the disk is slightly larger than the diameter of the tip. The pipe is slotted in four places after being brazed, and the sides are sprung in until they grip the tip sufficiently to hold the disk in place.—W. C. CHENEY.

This is the fourth and last of a series of articles on oxyacetylene cutting. Next month, oxyacetylene brazing.



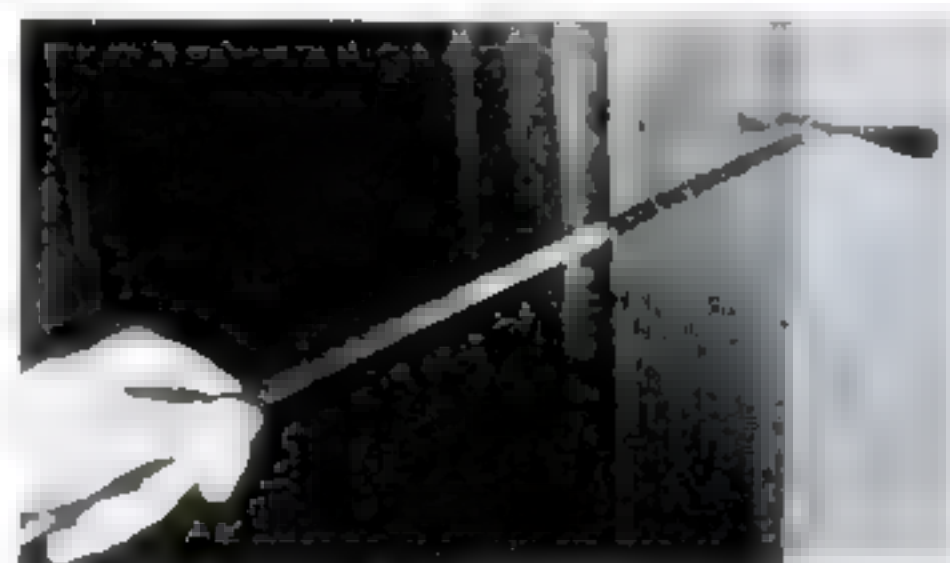
Above, cutting side plate for a bucket conveyor with the straight-line guiding attachment. At left, the members of the attachment



Front and back views of the disk used to protect torch head from the blowback when punching holes

## Measuring a Building Without Assistance

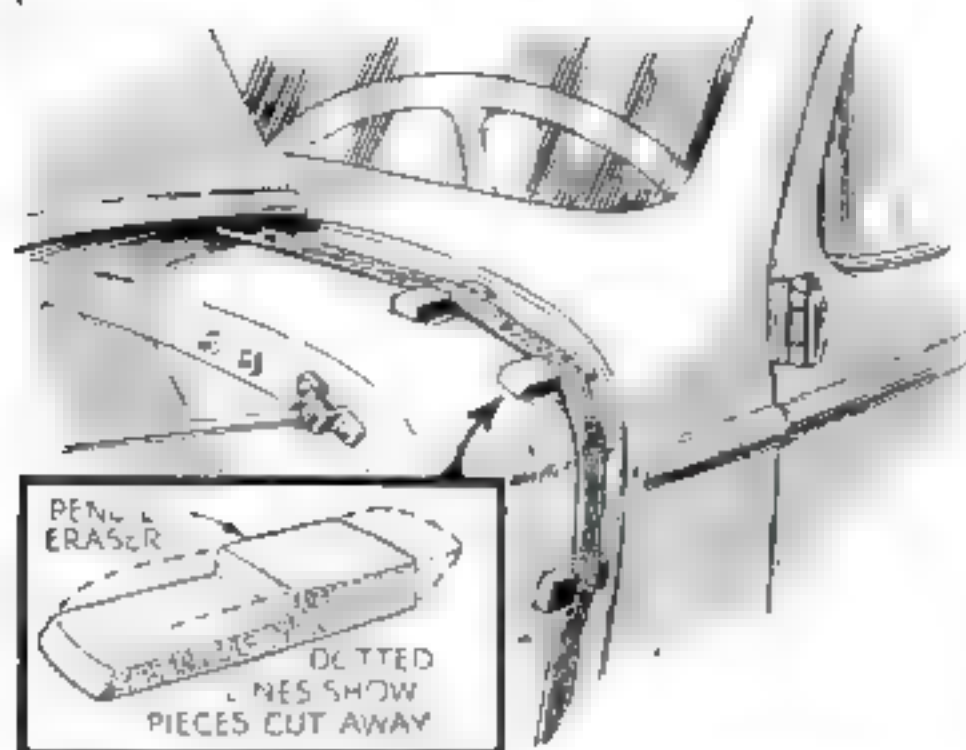
INTERIORS or exteriors of a building can be measured without an assistant by using a miniature screw driver to hold one end of the steel tape, as shown below. The screw driver is slipped through the ring of the tape and stuck in any available joint or crack.—J. S.



The end of the tape is held by a miniature screw driver, stuck into a joint or crevice



# Six Novel Kinks for Car Owners



## Hood Silencers Made from Rubber Erasers

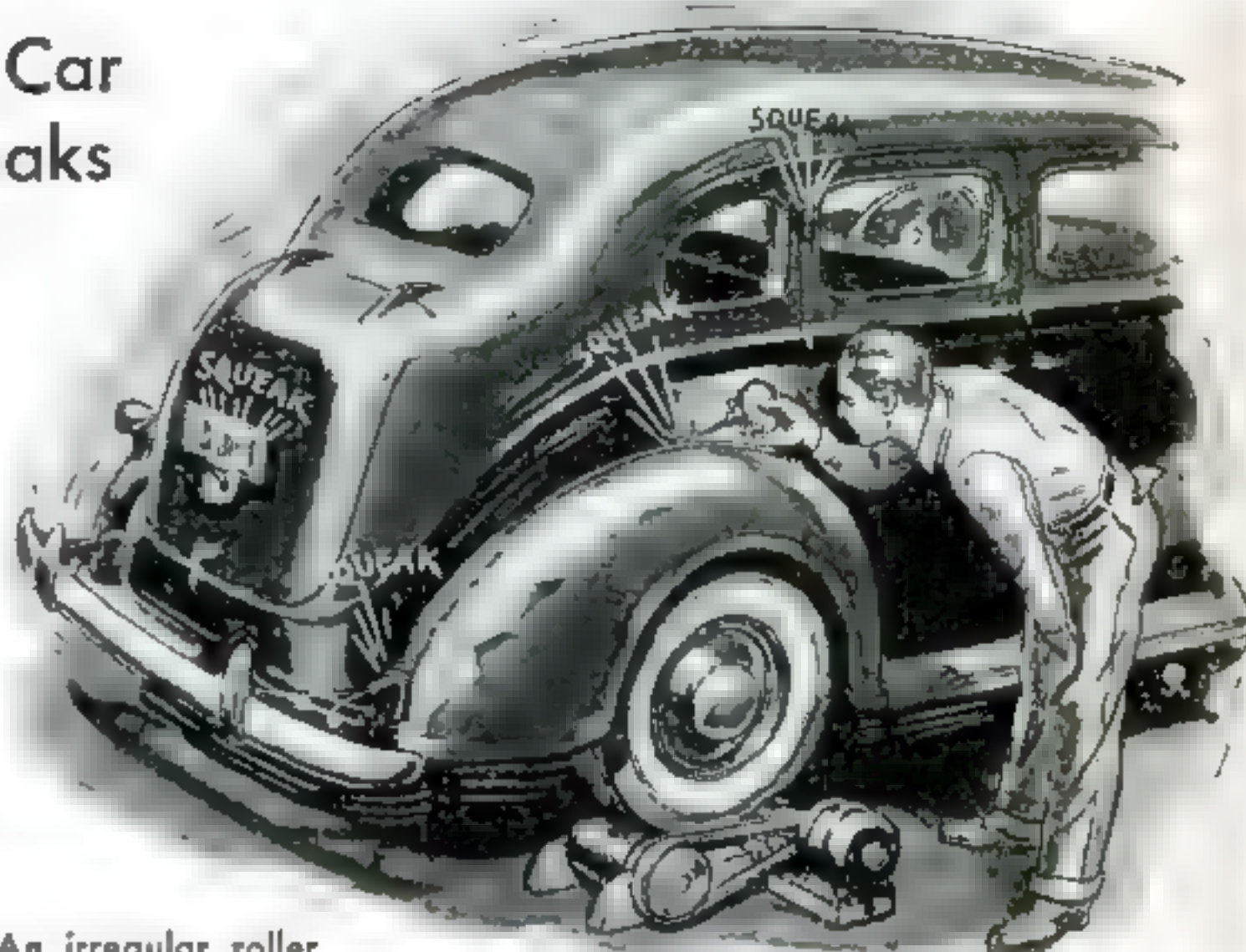
HOOD LACING that mats down and becomes hard with age often allows the hood to rub the body and cause annoying squeaks. Ordinary pencil erasers, notched as shown above and slipped under the lacing, will silence the noise. Pressure of the lacing is usually strong enough to keep the rubber silencers in place.—C. P.

## Tissues Useful in Car

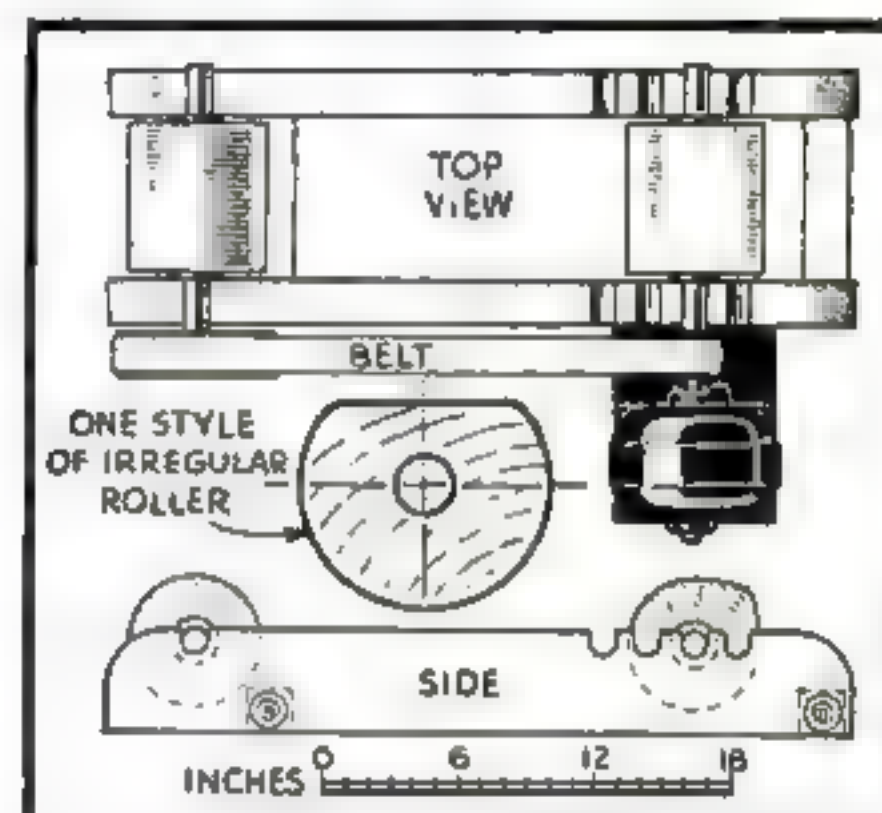
PAPER cleansing tissues that many women use for removing cosmetics are a handy accessory for your car. A box of these carried in the dashboard compartment provides handy dusters for cleaning the steering wheel, wiping fog or insects from the windshield, and a number of other uses.—K. P.

## Rollers Jiggle Car To Find Squeaks

BECAUSE squeaks and rattles are heard only when a car is in motion and are hard to locate on the open road, I rigged up a homemade "squeak finder" that puts my automobile over the bumps right in my garage. The unit consists of two wooden rollers that spin on a supporting base made of hard wood, as shown at the right. An electric motor turns one of the cylinders by means of a belt drive. One side of the car's rear axle is blocked up to keep it parallel with the ground when the wheel on the opposite side is lowered onto the unit. When the electric motor is started, the irregular shape of one of the rollers jars the car much as a rough highway would do. This makes it easy to spot squeaks, rattles, and other noises around the car, and oil them on the spot or make a note of them for later adjustment, oiling, and repair. The rollers may also be turned by putting the car in gear and running the engine.—E. C. H.

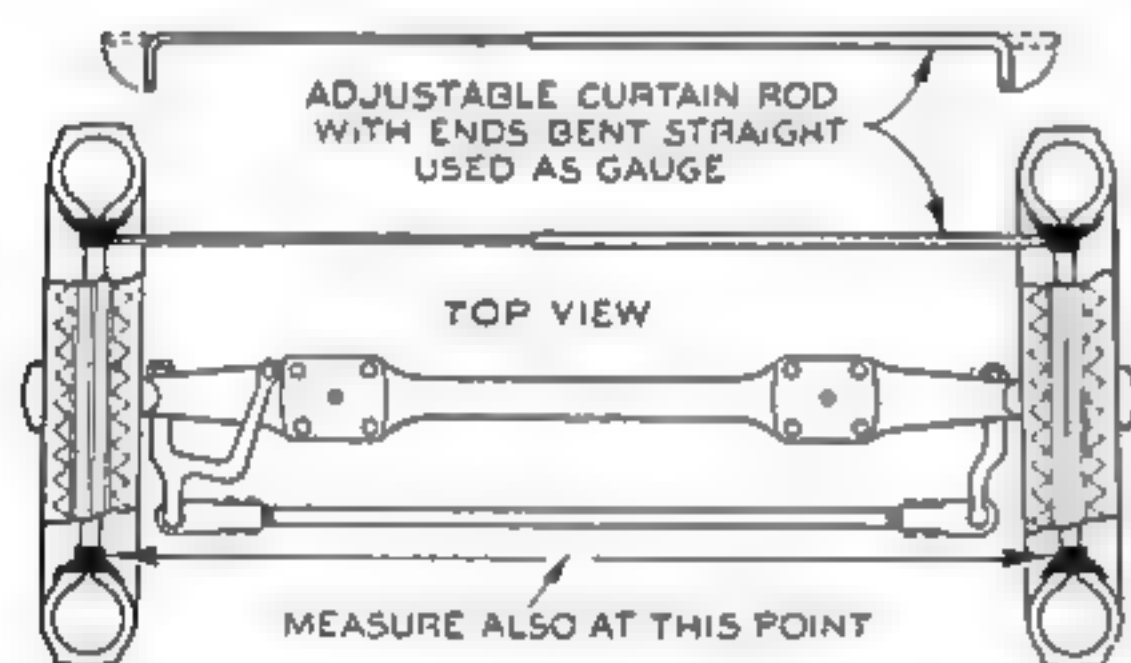


An irregular roller reproduces the effect of a rough road



How the noise finder is constructed. A third-horsepower electric motor is used to drive it

## Curtain-Rod Gauge Measures Wheel Toe-In

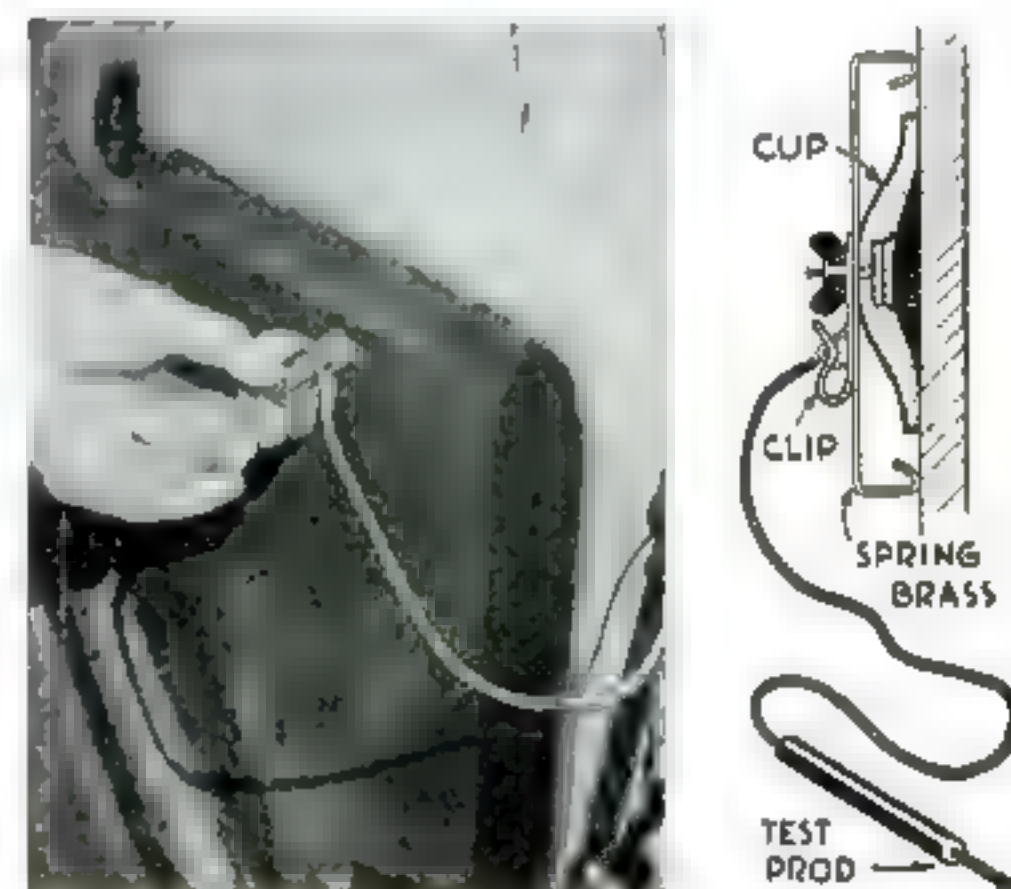
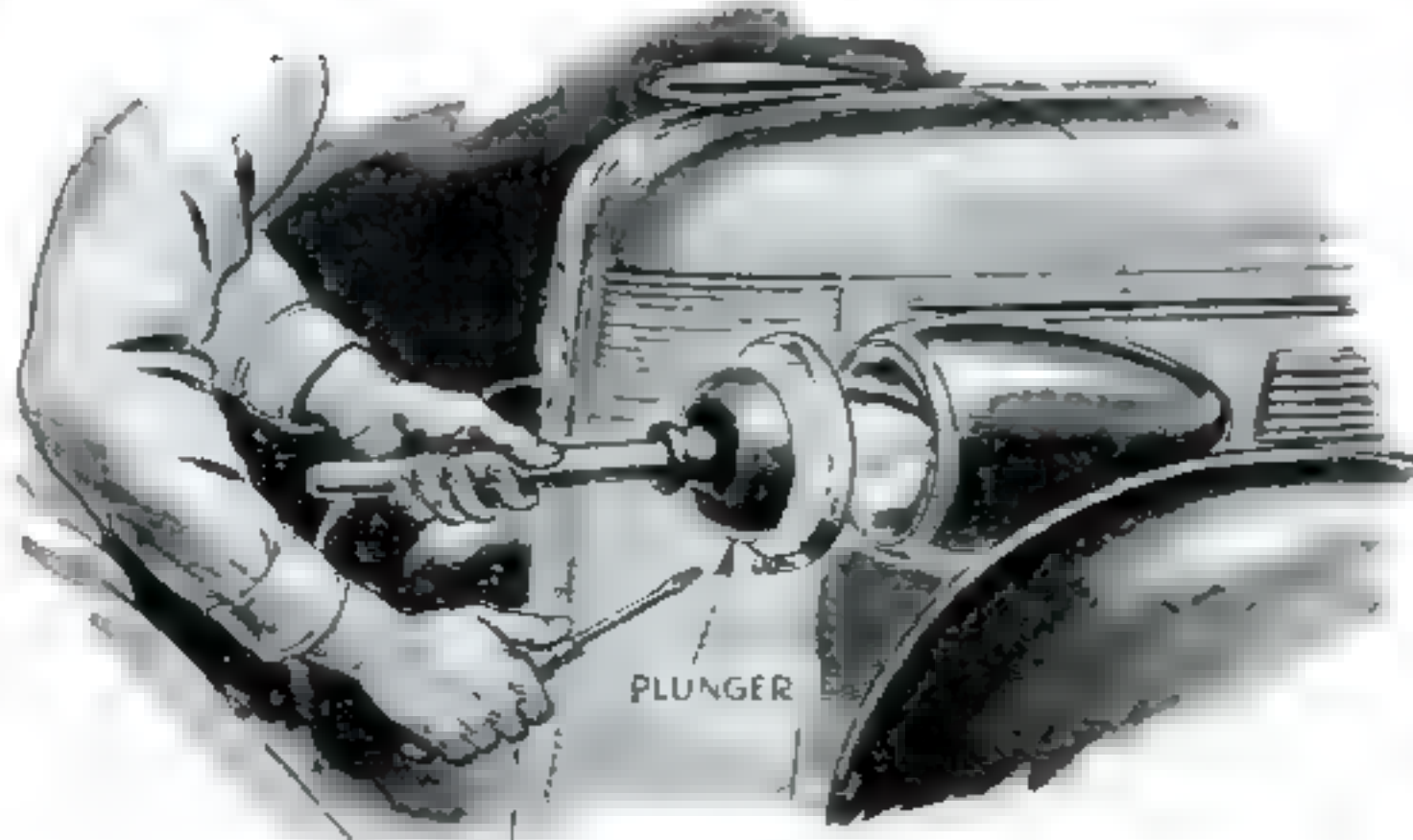


How a curtain rod is employed as a gauge for toe-in

A CURTAIN ROD of the telescoping type can be used to gauge the toe-in of an automobile's front wheels. After straightening out the tips as shown in the drawing, adjust the rod to fit snugly between the inner rims of the two wheels at their front edges. By marking the rod at the joint, and repeating the process at the rear edges of the rims, you can accurately determine the amount of toe-in.—S. R.

## Plumber's Friend Removes Headlamp Lenses

HEADLIGHT LENSES on late-model cars can be removed easily and with little danger of breaking them, with the aid of a "plumber's friend," or force cup, generally employed for cleaning drains. After the vacuum cup has been pressed against the lens, the headlamp screw is removed and the lens lifted out.—R. W. E.



## Vacuum Cup Holds Wire To Ground Test Circuit

FOR checking generators, wiring, or car electrical appliances, one end of the test circuit can be conveniently grounded on the chassis with the aid of a vacuum cup unit that adheres to smooth metal surfaces. A strip of spring brass bent to the shape pictured above and fastened to the vacuum cup by a screw and wing nut provides an excellent metallic contact. A spring clip soldered to the brass strip serves as a binding post for the test-circuit wire.—W. C. W.



# Slicing Specimens for

Thin Sections Are Easily Produced with the Help of a Homemade Microtome, or Mechanical Holding Device, the Construction of Which is Described

By MORTON C. WALLING



The homemade microtome being used for sectioning a plant stem. In this case, a straight razor is employed as the cutting tool

**S**INCE the compound microscope is primarily an instrument for looking *through* things at high magnification, the object on the glass slide must be, in most cases, thin enough to transmit light. Many objects, such as insect wings and the stripped-off epidermis of leaves, are naturally thin enough to make observation easy, even at high powers. But if the science of microscopy were restricted only to materials that nature had made ready for observation, our knowledge of biology and most of the other sciences would be meager indeed.

Early in the development of the microscope, it was found necessary to slice such things as plant stems into thin sections, in order to make visible the mysteries hidden in them. Such slicing was, at first, done entirely by hand. In fact, the art of free-hand sectioning is one that still is very useful to the microscopist, whether amateur or professional.

One popular way of cutting sections by hand is to hold the specimen—say, a plant stem—between the thumb and index finger of one hand, in such a way that the razor slides over, and is guided by, the thumb nail and side of the finger. Some workers find it convenient to lay the stem on a slab of cork or other

material that will not damage the razor blade, hold it with the thumb and finger, and slice it very much as you would cut a loaf of bread. Here, too, the thumb nail can be used to guide the razor.

Although free-hand sectioning is satisfactory to a surprising degree when done by a skilled worker, it is much easier to get first-class results by employing a mechanical device for holding the material being cut and for feeding it past the sectioning knife with such control that the thickness of each slice can be determined very accurately. Such a slicing machine is called a

microtome, meaning "small-cutter."

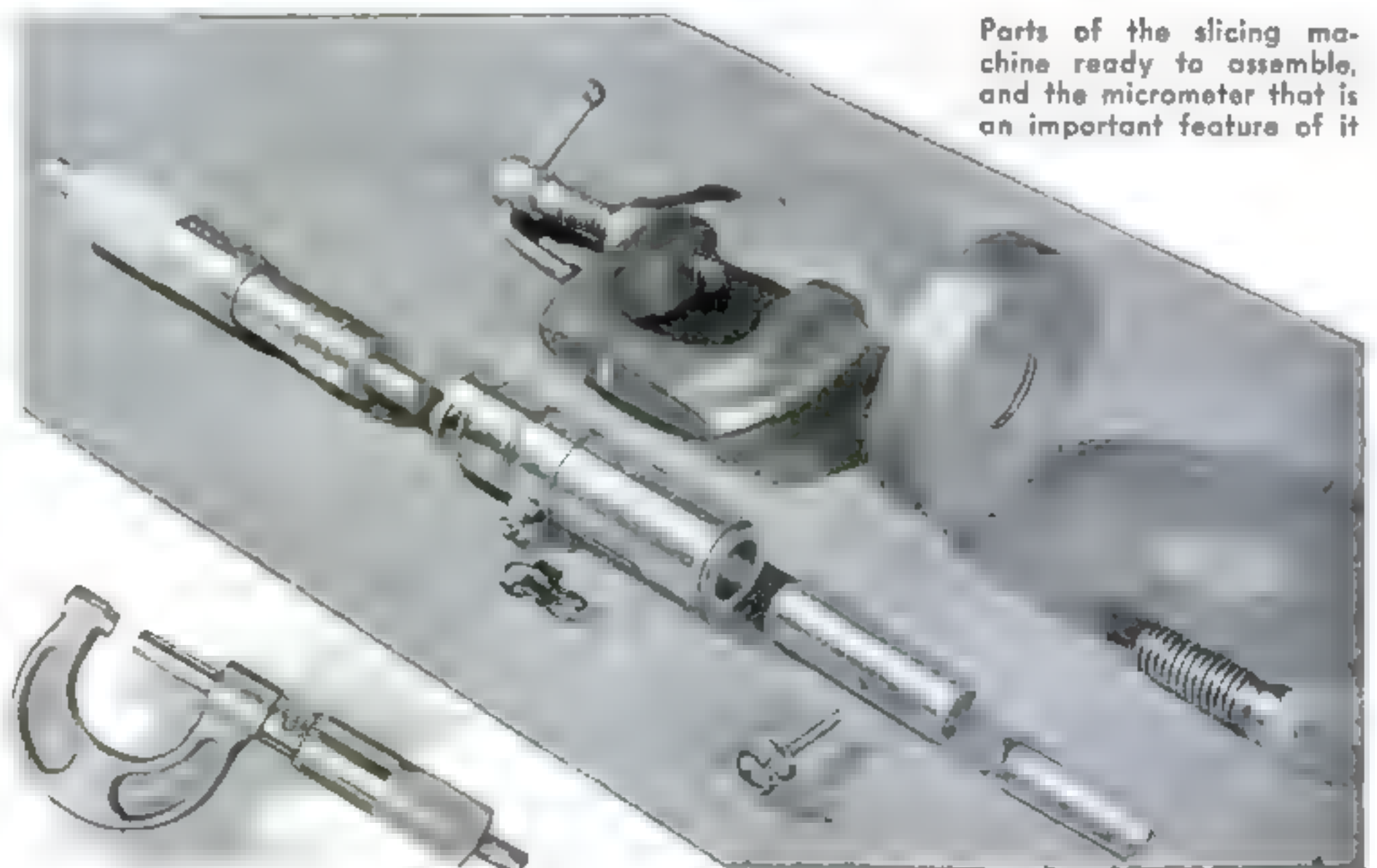
You can, of course, purchase professional microtomes for making sections. A good hand microtome costs about \$16.50, while the price of a highly refined mechanical one may run to \$600 or more. These machines are built with

the precision of microscopes, for they work to tolerances of less than a micron (one thousandth of a millimeter).

It is not at all difficult for the amateur microscopist to build his own slicing machine. Although the construction will be much easier if a metal-working lathe is available, it is possible to turn out a satisfactory job with ordinary tools.

The instrument consists essentially of a body tube, inside of which is a sliding tube or "object holder" that grips the material being sliced. The upper end of the body tube is fitted with a circular platform over which the knife blade slides, and the lower end is provided with a micrometer screw to control the thickness of the sections. Dimensions are given for the various parts, but these can be varied to suit your own ideas or materials. Since the metric system of measurement is standard for microscopes and similar instruments, dimensions will be given in centimeters and millimeters. However, if you want to change them into the English system, a millimeter can be taken as equal to 0.03937 in., and a centimeter to 0.3937 in. An inch equals approximately 2.54 centimeters, 25.4 millimeters, or 25,400 microns.

The body tube is turned from brass. It is 6.5 cm. long and 18 mm. outside diameter, with an inside bore of about 12 mm. The bore extends to a depth of 48 mm. The upper end of the tube



Parts of the slicing machine ready to assemble, and the micrometer that is an important feature of it



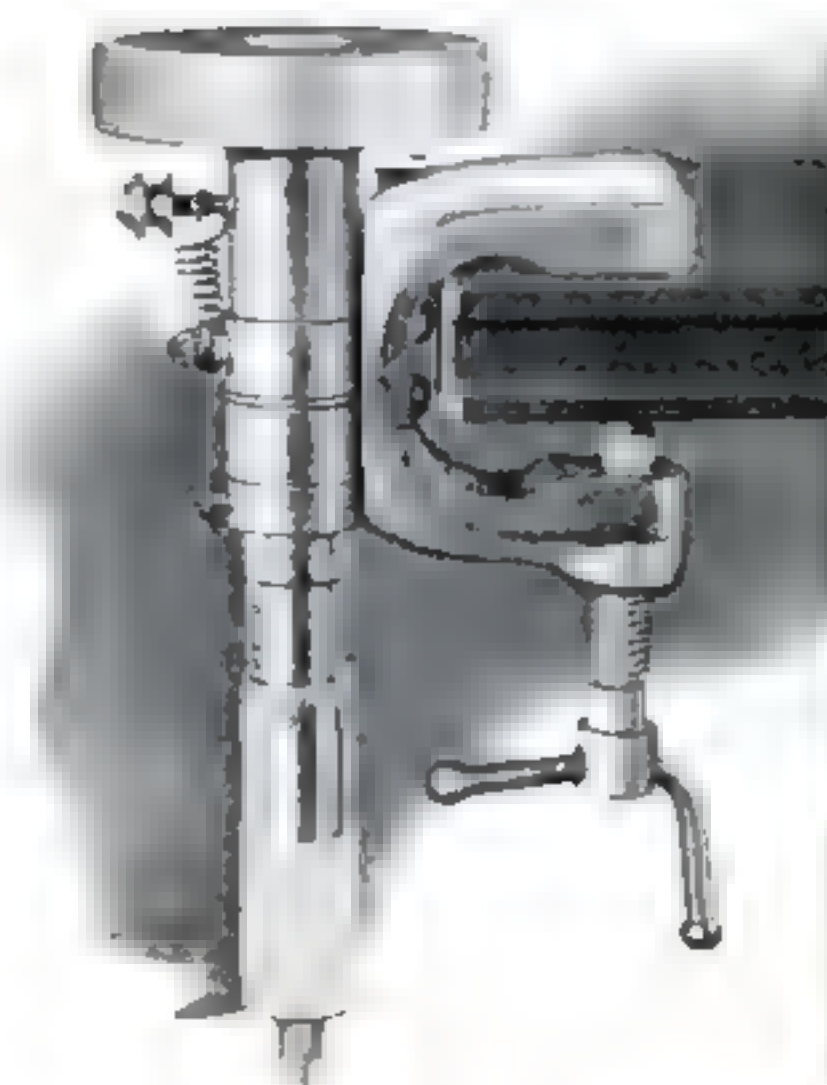
# Your MICROSCOPE

(open end of the bore) is provided either with threads or with a collar, to enable the circular cutting table, 50 mm. in diameter, to be attached. This tube, while best made on a lathe, can be simply a length of brass tubing of any convenient diameter. The tube walls ought to be no less than 2 mm. thick.

Sliding inside the bore is the object holder, similarly made from brass. It has an outside diameter that permits it to fit very snugly in the bore, and a length of 3.6 cm. Wall thickness should be about 1.5 mm. In the microtome illustrated, this part has an outside diameter of 12 mm., an inside diameter of 9 mm., and a length of 3.6 cm.

Beginning about 15 mm. from the top of the body tube, and extending downward for another 15 mm., is a slot in which a 6-32 machine bolt will slide freely. With the object holder inside the body tube, and with the upper ends of both tubes even, make a punch mark on the object holder at the upper end of the slot, and drill and tap it to receive a 6-32 bolt. This bolt, which should be fitted with a knurled nut or head to make it easy to turn, does several things: it serves to clamp the object in position, it limits the upward movement of the object holder so that the knife will not strike the metal, and it serves as an anchorage for one end of a small coil spring whose purpose will be described later.

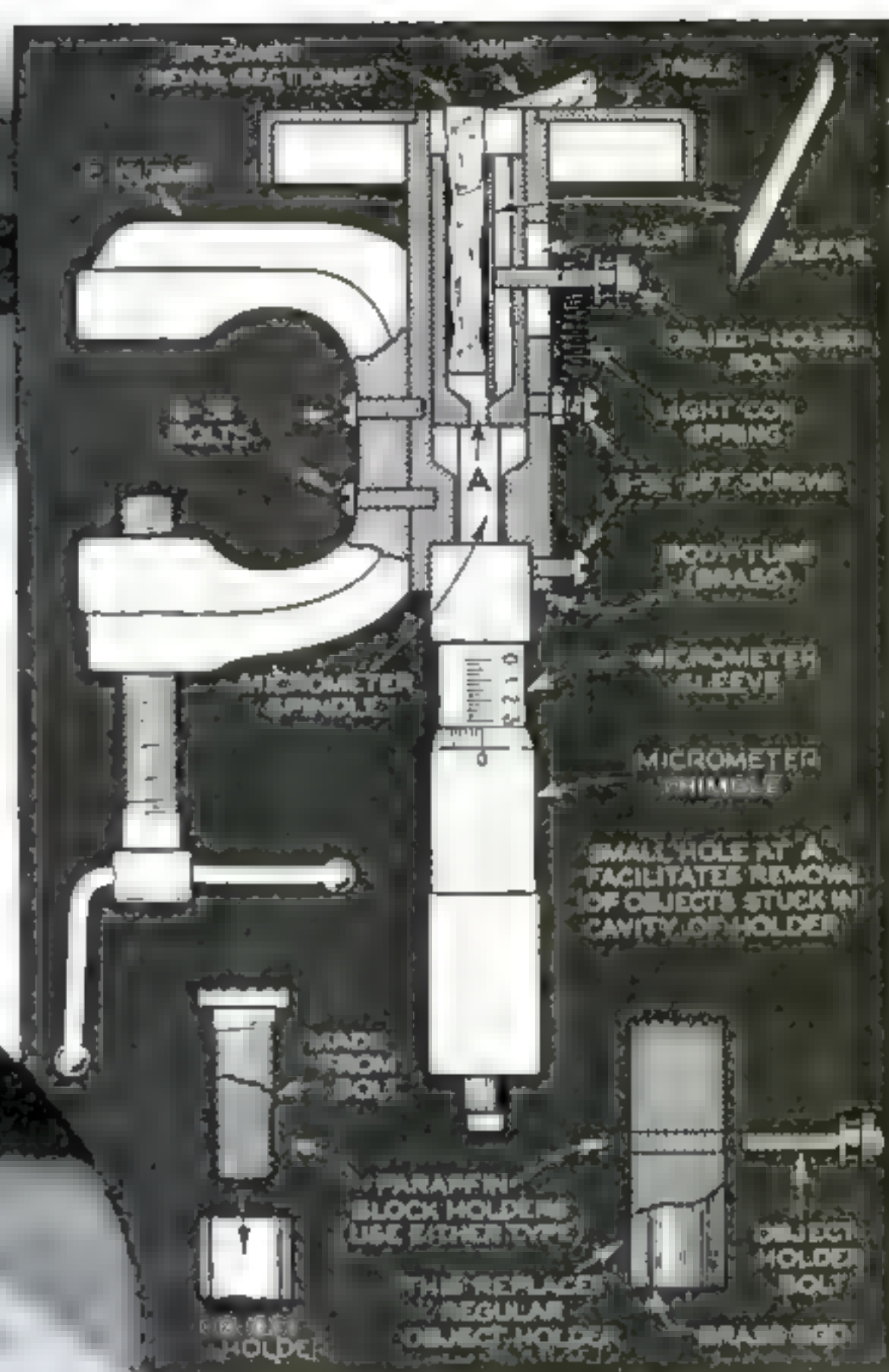
Obtain, at your local hardware or dime-and-dollar store, an inexpensive micrometer of the type illustrated, and of a size that measures diameters up to one inch. This costs about fifty cents. With a hack saw, remove the curved frame as shown, and file or turn the end of the cylindrical, graduated sleeve until it is uniformly round, and perhaps slightly reduced in diameter. Drill or bore out a socket in the lower end of the microtome body tube to receive this end of the sleeve, to a depth of about



Microtome fastened to a table edge by means of its C-clamp attachment. Below, hand-held type in operation



7 mm. The sleeve should fit snugly in the socket. It is held by one or two set screws extending through tapped holes in the body tube. One of these screws can be used to anchor the lower end of the coil spring, although in the photo-



Details of the slicing tool showing how it is assembled from a fifty-cent micrometer

graphs another screw, farther up the side, is shown.

The movable spindle is 6.35 mm. ( $\frac{1}{4}$  in.) in diameter. To make room for it in the body tube, drill a hole about half again as large, connecting the bore and the socket for the micrometer sleeve. Now, with the parts assembled, you can feed the object holder upward by turning the thimble (knurled, movable part) of the micrometer to the right. It would be better if a [\(Continued on page 121\)](#)

## Don't Handicap Your Instrument with Dirty Lenses

DIRTY lenses are a common cause of poor performance in a compound microscope. If you see spots when you look into the instrument, the chances are that the eyepiece lenses are dirty. Rotate the eyepiece while looking through it and if the spots rotate too, you can be certain the trouble is there. Dirty objective lenses cause general loss of definition.

Make it a habit to remove the objectives periodically and clean them, especially the inner surfaces where dust falling down the tube settles. With a fine camel's-hair brush, you

can lift off much of the dirt without scratching the glass. Finally, after the gritty particles have been removed in this way, clean the lens surfaces with special lens tissue, or with a *well-washed* piece of linen or chamamois skin. Wipe gently with a circular motion, and if necessary moisten the glass by breathing on it.

Never use alcohol, water, or other liquid for cleaning high-grade lenses, except when you employ xylol to remove immersion oil from high-power objectives. If you clean an oil-immersion objective immediately after it is used, you generally need nothing

more than lens paper. Revolve the lens against the paper, so that the glass is wiped with a circular motion.

Much trouble can be avoided by keeping dirt from the lenses in the first place. Do not attempt to take an objective apart, unless it is of a type that is divisible to produce different magnifications. Keep removable objectives in their screw-capped containers when not in use. If you do leave them attached to the microscope, store the instrument under a bell jar or in some other dust-tight container when not in use.



# Color Chemistry

RAINBOW HUES HELP IDENTIFY UNKNOWN SUBSTANCES



A test with a homemade colorimeter shows how absorbent cotton "adsorbs" lead from a solution of lead nitrate

By  
**RAYMOND B. WAILES**

**C**OLORS that appear when you mix different chemicals in your test tubes may be informative as well as entertaining to produce. Often it is by observing such tints that professional chemists analyze substances and determine what is in them. Even the amount of a particular ingredient can sometimes be estimated with surprising accuracy in this way. In your own home laboratory, you will enjoy trying out a few color tests that will enable you to identify a variety of substances.

By color, for example, you can easily distinguish tungsten from the variety of other substances that a radio tube contains—including barium, magnesium, nickel, copper, iron, manganese, and molybdenum. Break open a discarded radio tube and remove the filament. Heat this part in a porcelain evaporating dish, or on a piece of sheet iron. Soon the metallic luster will disappear and the material will turn yellow.

With a pair of forceps, transfer some of the yellow substance to a strip of aluminum that has been freshly cleaned with emery cloth. Add a drop of weak hydrochloric acid. The blue color that forms in the liquid is a characteristic reaction of tungsten, and shows that the metal was present in the filament. The intermediate product formed by heating the metal was the yellow trioxide of tungsten.

You can perform the test for tung-

sten in another way by placing some of this trioxide in a test tube, adding several cubic centimeters of dilute hydrochloric acid, and warming it gently. Then add to the solution a piece of tin—not the kind in tin cans, which is sheet iron coated with tin, but the pure metal. A blue color or precipitate will then show that tungsten is present. This test can be applied to minerals suspected of being tungsten ores by heating some of the crushed ore with hydrochloric acid, in which the tin is then placed. Either of the methods used for the radio-tube filament will also detect the tungsten in the filament of an ordinary electric-light bulb.

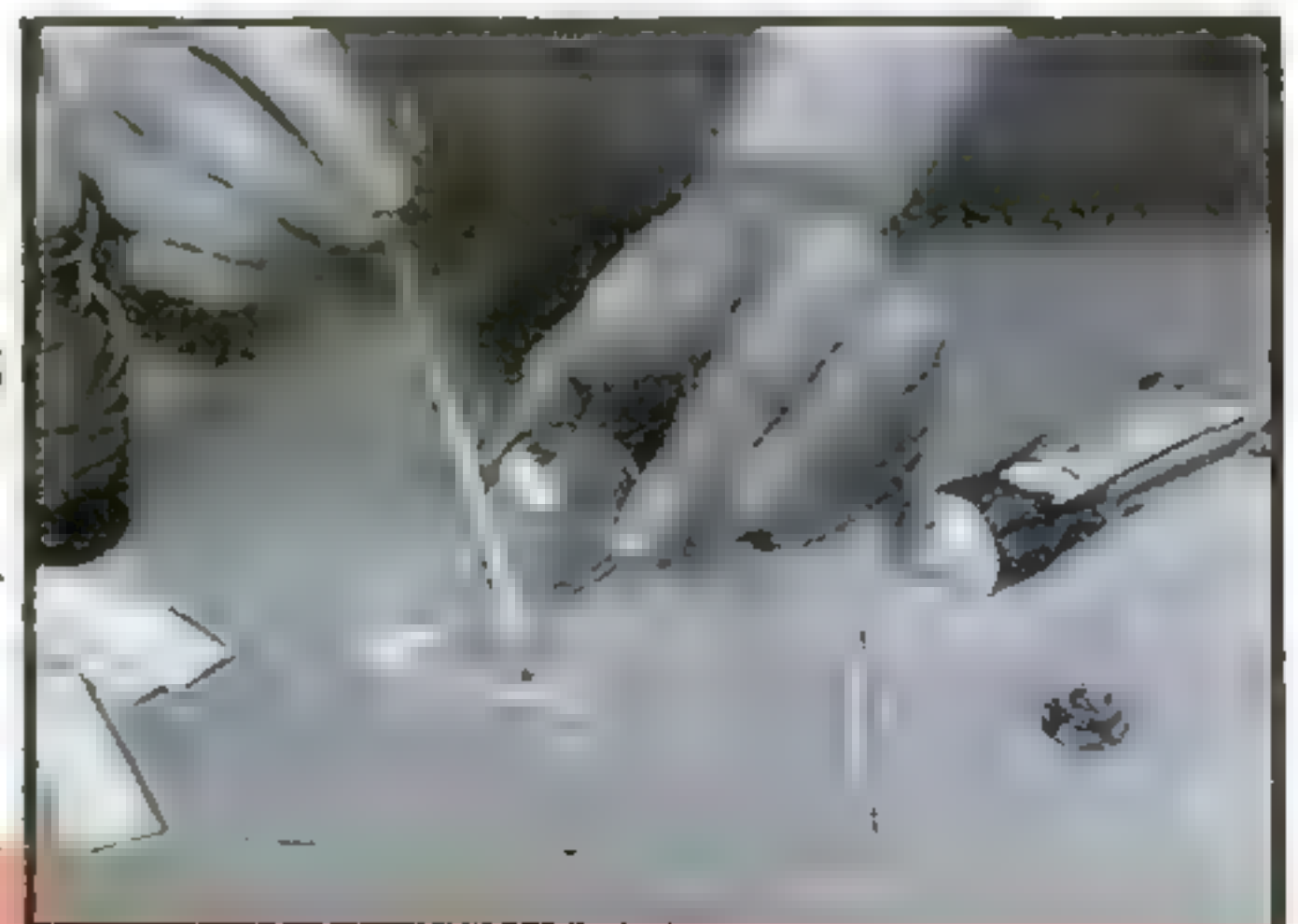
Because many of them contain potassium chlorate, ordinary weed killers of the type used by the home gardener provide an excellent opportunity to try the test for a chlorate. Homemade test papers for the purpose are easy to prepare. Dissolve two grams of ammonium thiocyanate (also known as ammonium sulphocyanide) in ten cubic centimeters of water, and soak several strips of filter paper in the solution. Thread the papers on a string, and let them dry in a place no hotter than seventy degrees centigrade (about 160 degrees Fahrenheit). They will then be ready for use.

PARAFFIN WAX AND SULPHUR

CIGARETTE LIGHTER

This is a handy generator for making the hydrogen sulphide used in the experiment

## Making Test Papers To Detect Chlorates in Household Products



Chlorates contained in weed killer and other household products are detected by means of test papers made by soaking filter paper in an ammonium thiocyanate solution



For the test, rub a bit of the weed killer and a little water together upon a watch glass with a stirring rod. Then transfer a drop or two of the resulting liquid, with the rod, to one of the test papers. Place the paper in a warm place—that is, with a temperature of about 100 degrees centigrade. For example, you can lay the paper in a large watch glass suspended over a jet of steam, from the mouth of a flask of boiling water. If a chlorate is present, such as potassium chlorate, the paper will turn yellow during the next five to thirty minutes.

You will know exactly what to look for if you make a preliminary test, using a crystal of potassium chlorate instead of the weed killer and proceeding as just described. Left-over test papers can be employed to detect chlorates that may be present in any mixture.

Ammonium thiocyanate, the reagent you employed in this test, will also enable you to determine whether there is iron in the drinking water you use in your home. Commonly it is present, but at most there will be very little of it, so you will need to concentrate it for your test. This may be done by evaporating or boiling down about 100 cubic centimeters (three or four fluid ounces) of tap water in a beaker, until only a few drops of water remain. At this point, add a drop of chemically pure hydrochloric acid, and continue evaporating just to dryness.

Now add several more drops of hydrochloric acid, followed by five cubic centimeters of water and a drop of nitric acid. Warm the solution gently, and transfer it to a test tube. Rinse the beaker with several cubic centimeters of water, which should also be placed in the test tube. Finally, add to the test tube one or two cubic centimeters of a dilute solution of ammonium thiocyanate or of potassium thiocyanate, made by dissolving two grams (a teaspoon holds approximately five grams) of either chemical in 100 cubic centimeters of water. The solution in the tube will now turn red if there was an appreciable amount of iron in the water, the depth of color increasing



How a radio tube can be broken safely to obtain the filament for a tungsten test

with the quantity of iron. Traces of iron too small to respond to the test just described can be detected by starting with a greater amount of water—say, 250 cubic centimeters (an average drinking glass)—and proceeding as before.

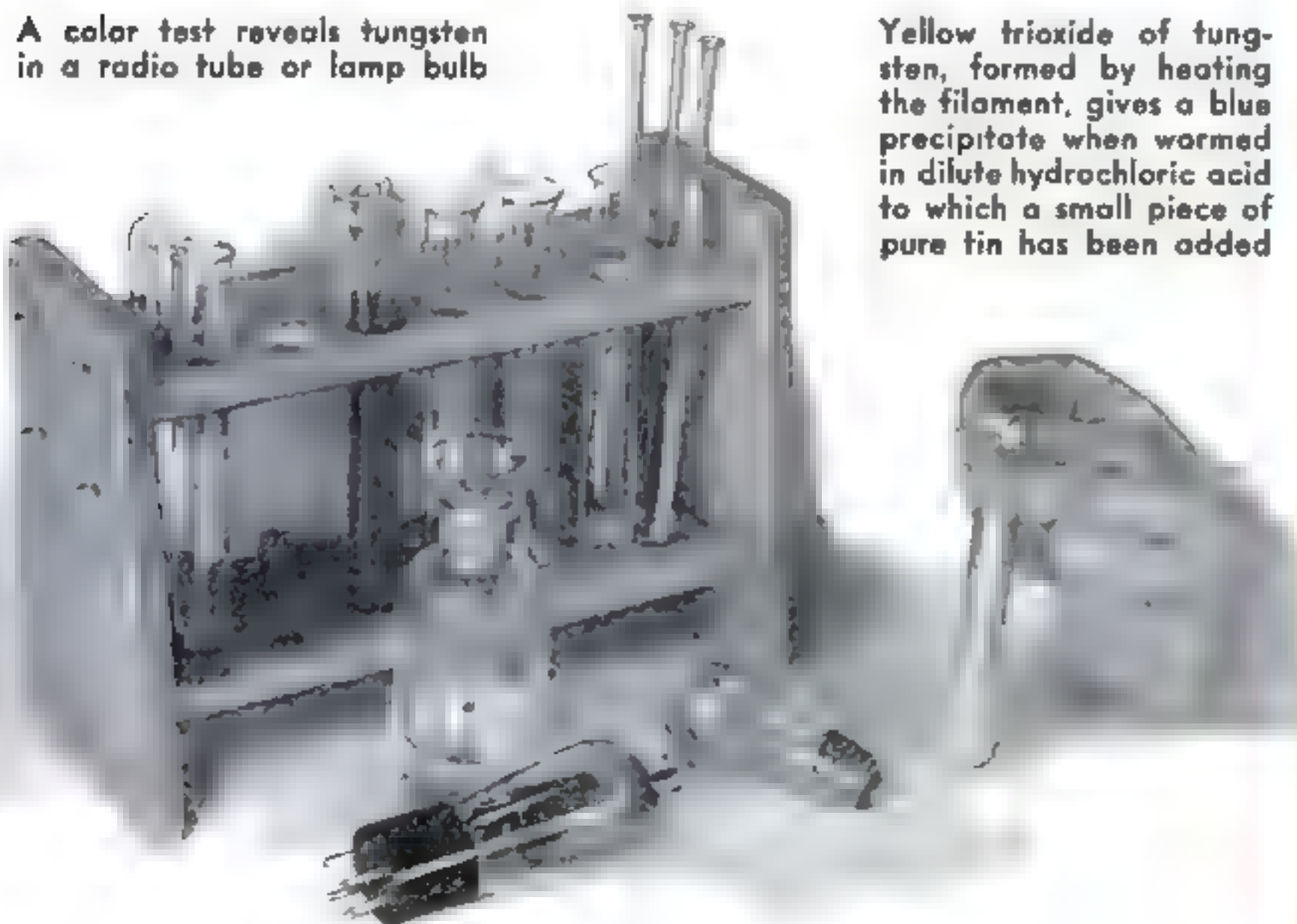
Professional analysts observe color reactions like this with the aid of a device called a colorimeter, which enables them to detect the slightest color change and even to gauge the amount of iron or other material present. You can make yourself a simple but effective colorimeter from an ordinary test-tube rack. As shown in an accompanying illustration, all you need add is a rest for the bottoms of the tubes, and a reflecting surface mounted beneath it at a forty-five-degree slant. The reflector may be white paper, covered with a sheet of glass. To compare the colors of solutions in a pair of test tubes, you place the tubes in the colorimeter and look straight down into them. Light from the reflector, passing up through the length of the solution in each tube, shows up the

color much more plainly than you can observe it by viewing the tube from the side.

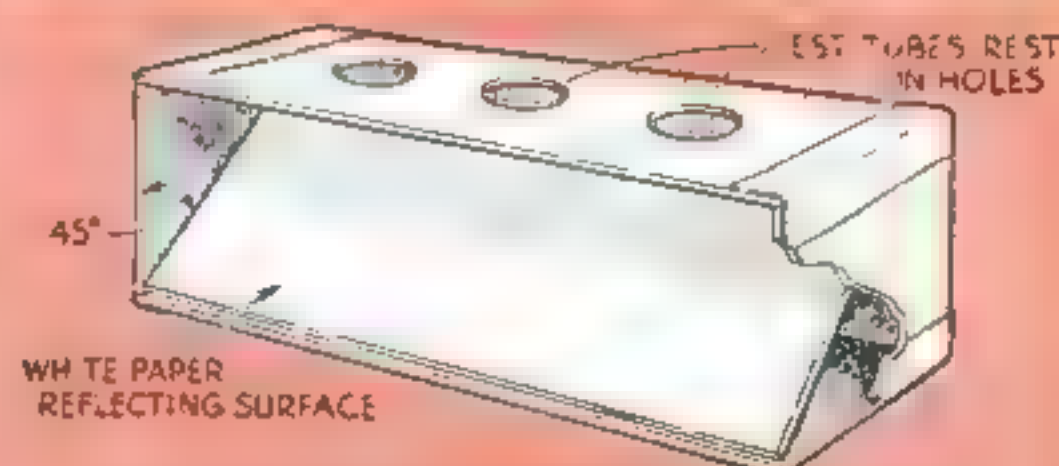
Suppose you take 100 cubic centimeters of water from each of two sources—say, your home supply and a near-by spring—and proceed in exactly the same way, with the same amounts of chemicals, to test each one for iron. Then you can place the two tubes of colored solution in your colorimeter and determine at once from the depth of shade which kind of water contains more iron. To measure the exact amount, a professional chemist would simply match the color of the test solution against a set of "standard" solutions, containing known amounts of iron and submitted to the same procedure.

Through the curious process known as "adsorption," a wad of absorbent cotton will actually abstract material from a solution in water, as you can demonstrate with your homemade colorimeter. Dissolve a bit of lead nitrate or of lead acetate, approximately the size of the head of a pin, in about 500 cubic centimeters of water. Immediately measure out two accurate 100-cubic-centimeter portions of the liquid and place each one in a clean beaker. Drop a piece of absorbent cotton in one of the beakers, and swirl it around with a stirring rod for about five minutes. The contents of the other beakers may [\(Continued on page 125\)](#)

A color test reveals tungsten in a radio tube or lamp bulb



Yellow trioxide of tungsten, formed by heating the filament, gives a blue precipitate when warmed in dilute hydrochloric acid to which a small piece of pure tin has been added



A HOMEMADE COLOR-GAUGING DEVICE

An ordinary test-tube rack makes an effective colorimeter when fitted with the reflecting bottom rest shown in the drawing. Light reflected upward through liquids reveals comparative colorations



# Suitcase Radio

**HAS  
BUILT-IN AERIAL  
AND SPEAKER**

**W**HETHER you travel a great deal or not, this handsome suitcase portable receiver will form a useful addition to your radio equipment. Powered by a built-in battery supply, it can be used on picnics, at the beach, in your car, or in a boat or canoe. Little larger than an ordinary hat box, it can be just as easily tucked away in a corner of a closet when not in use.

Besides its portability, the compact circuit has another feature that makes it one of the few outfits that can be put into immediate operation anywhere without first rigging a troublesome antenna or installing a ground. This convenience has been incorporated by winding the circuit's grid and tickler coils around a specially constructed frame mounted inside the top of the case (see photograph on opposite page). This large coil, which acts as a loop antenna, consists of twenty-four turns of No. 24 double-cotton-covered copper wire,

tapped at the sixth turn to divide it into two sections.

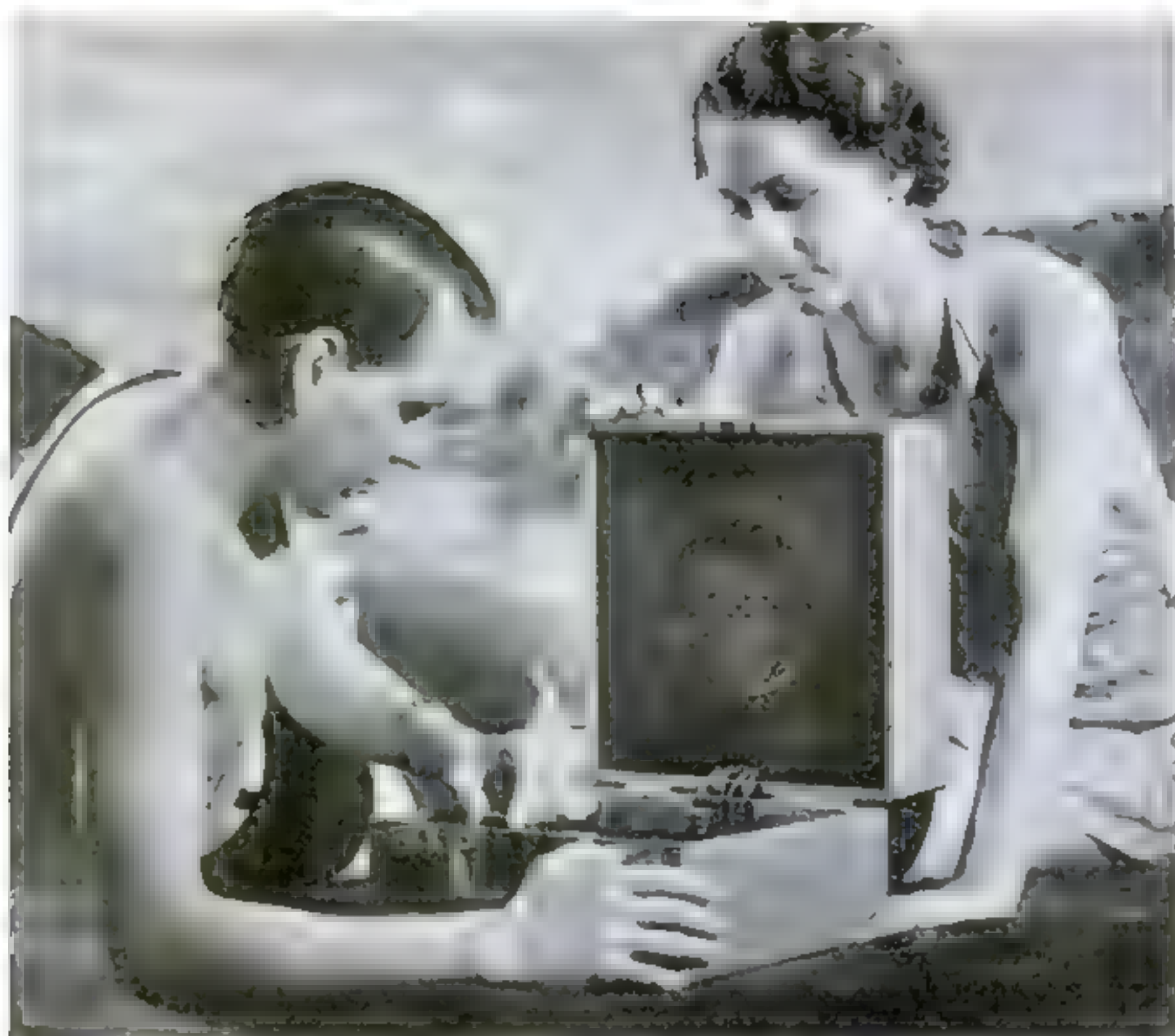
The larger section serves as the receiver's grid coil and a special compact variable condenser connected across it, as shown in the diagram, provides the tuning adjustment. This type of condenser, which has thin sheets of insula-

tion between the fixed and movable plates instead of the usual air space, can be obtained from most large mail-order, radio-parts supply houses. Because it requires less mounting space than the ordinary tuning condenser, it is an ideal unit for use in portable circuits. However, if you have difficulty obtaining one, you can, by rearranging the placement of parts slightly, substitute the conventional air-spaced unit.

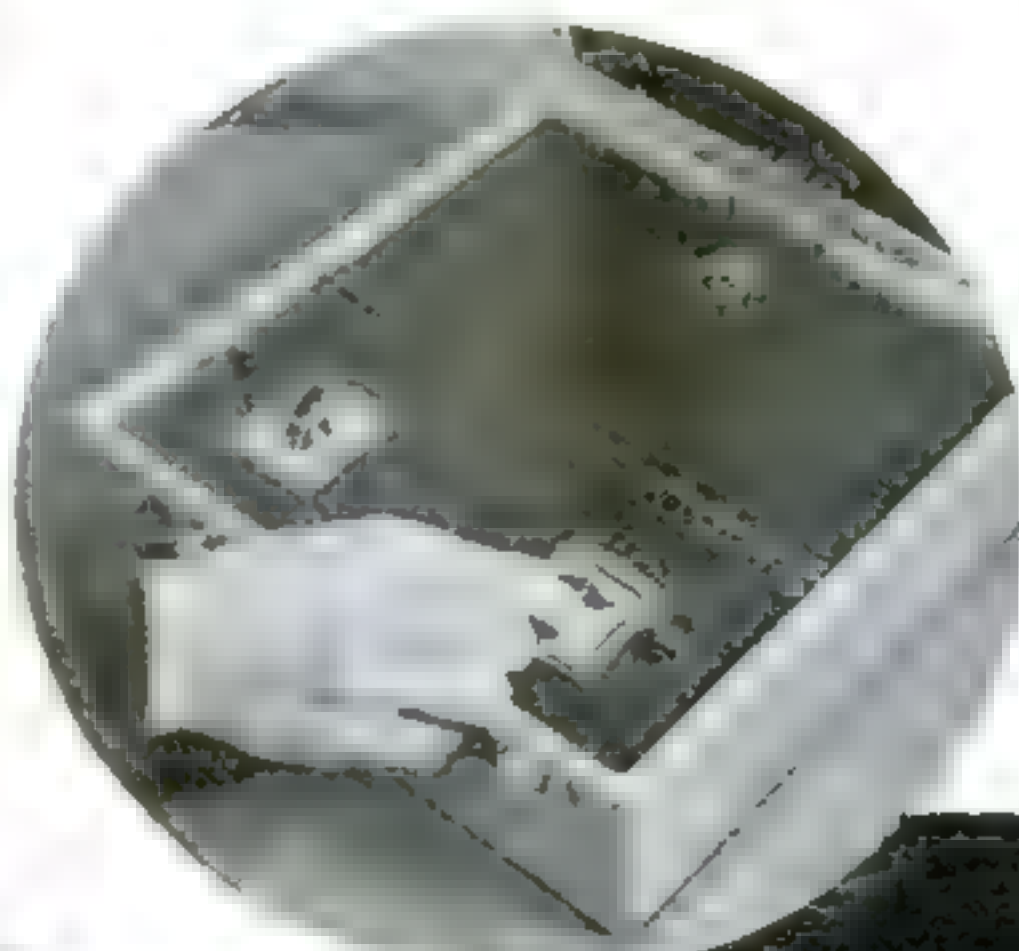
The smaller section of the coil is the tickler winding and is connected through a .00005-mfd. fixed mica condenser to the plate of the first tube (1E5G). A 15,000-ohm variable potentiometer, connected across the coil serves as the regeneration control.

To eliminate the necessity of using several tuning condensers, the radio-

Two controls operate the receiver circuit, whose parts and three tubes are mounted as shown below

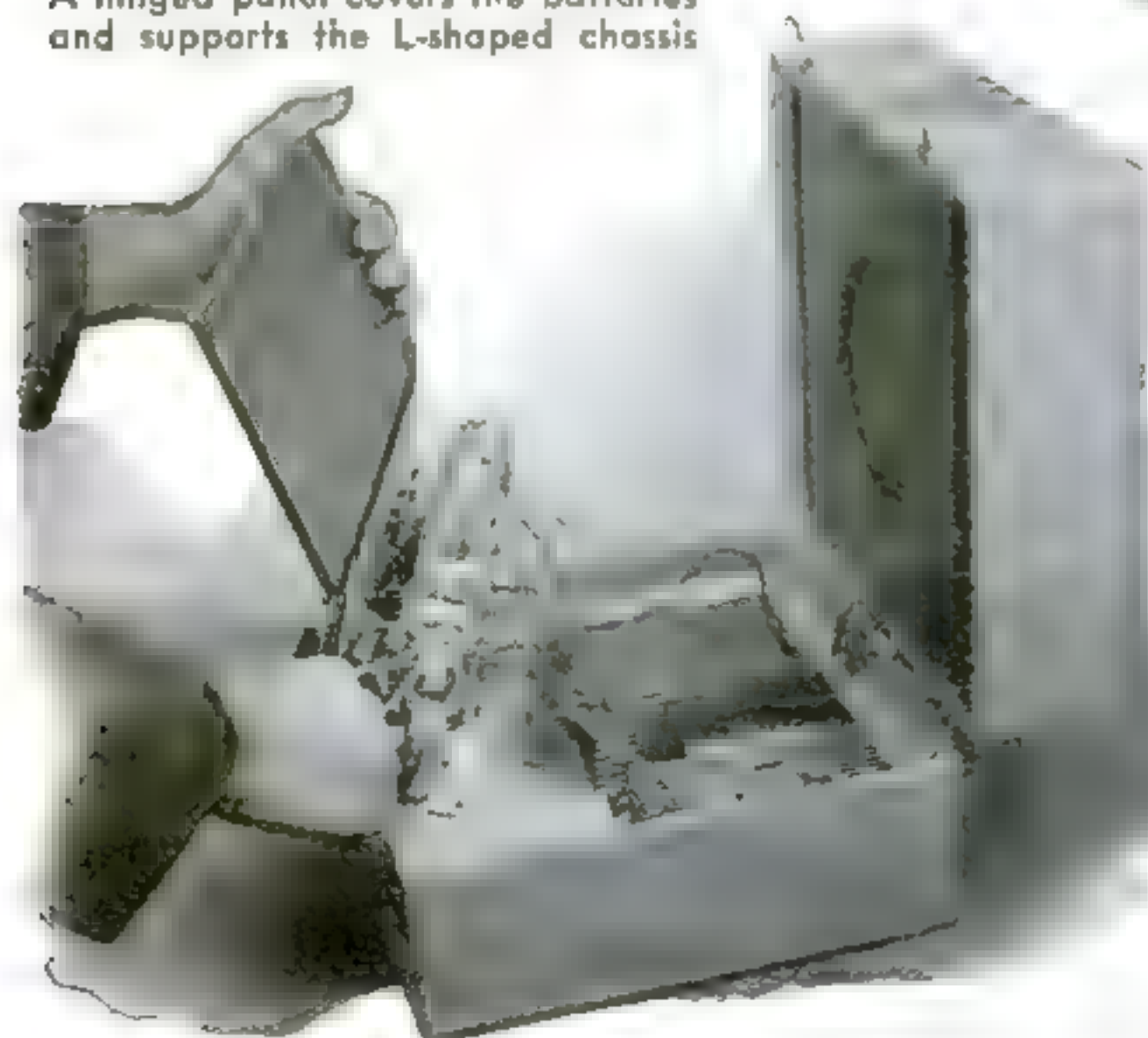


This attractive portable will provide radio entertainment anywhere



By **ARTHUR MILLER**

A hinged panel covers the batteries and supports the L-shaped chassis





frequency tube is untuned and coupled to the detector (1E5G) by means of a 125-mh. iron-core plate choke and a .00025-mfd. fixed mica condenser. The detector tube is in turn resistance-coupled to the pentode output tube (1E5G). A radio-frequency filtering system, consisting of a small 2.5-mh. choke and a .0005-mfd. mica condenser, has been placed in the output circuit of the detector tube in order to isolate the radio-frequency portion of the set from the audio-frequency section. To further improve the stability and tuning, a .004-mfd. mica by-pass condenser is connected between the plate of the last tube and the metal chassis, and the aluminum frame of the six-inch magnetic speaker is grounded through the tapped portion of the combination coil and loop antenna, as shown in the diagram. Since the depth behind the loudspeaker panel is little more than two and five eighths inches, the builder must be careful to choose a speaker having its bulky magnets mounted to one side of the center of the cone rather than at the rear. Such speakers are readily available.

The lower portion of the suitcase houses the complete "A" and "B" battery supply and the receiver circuit proper. The three tubes specified are the latest glass-metal types with octal bases. Tight fitting shields should be used on the first two tubes, and care must be taken to see that they are grounded to the aluminum chassis.

In placing the batteries notice that the 4½-volt "C" unit is placed to one side of the radio-frequency tube. It is held in position by a thin aluminum band bolted to the chassis, the metal strip making connection with the positive terminal of the battery. A three-ohm fixed resistor mounted directly behind the power tube serves to reduce the three-volt "A" battery to the two volts recommended for the filaments of the tubes. Two portable-size, forty-five-volt "B" batteries connected in series provide the ninety volts required for the plate supply.

The chassis, which is L-shaped, should measure 3 by 4½ by 10¼ inches. It can be bent easily from sheet aluminum.

In mounting the circuit, particularly the tube sockets, place a piece of cardboard between the parts and the aluminum chassis. This will eliminate any possibility of the soldering lugs coming in contact with the metal, which would

produce a short circuit.

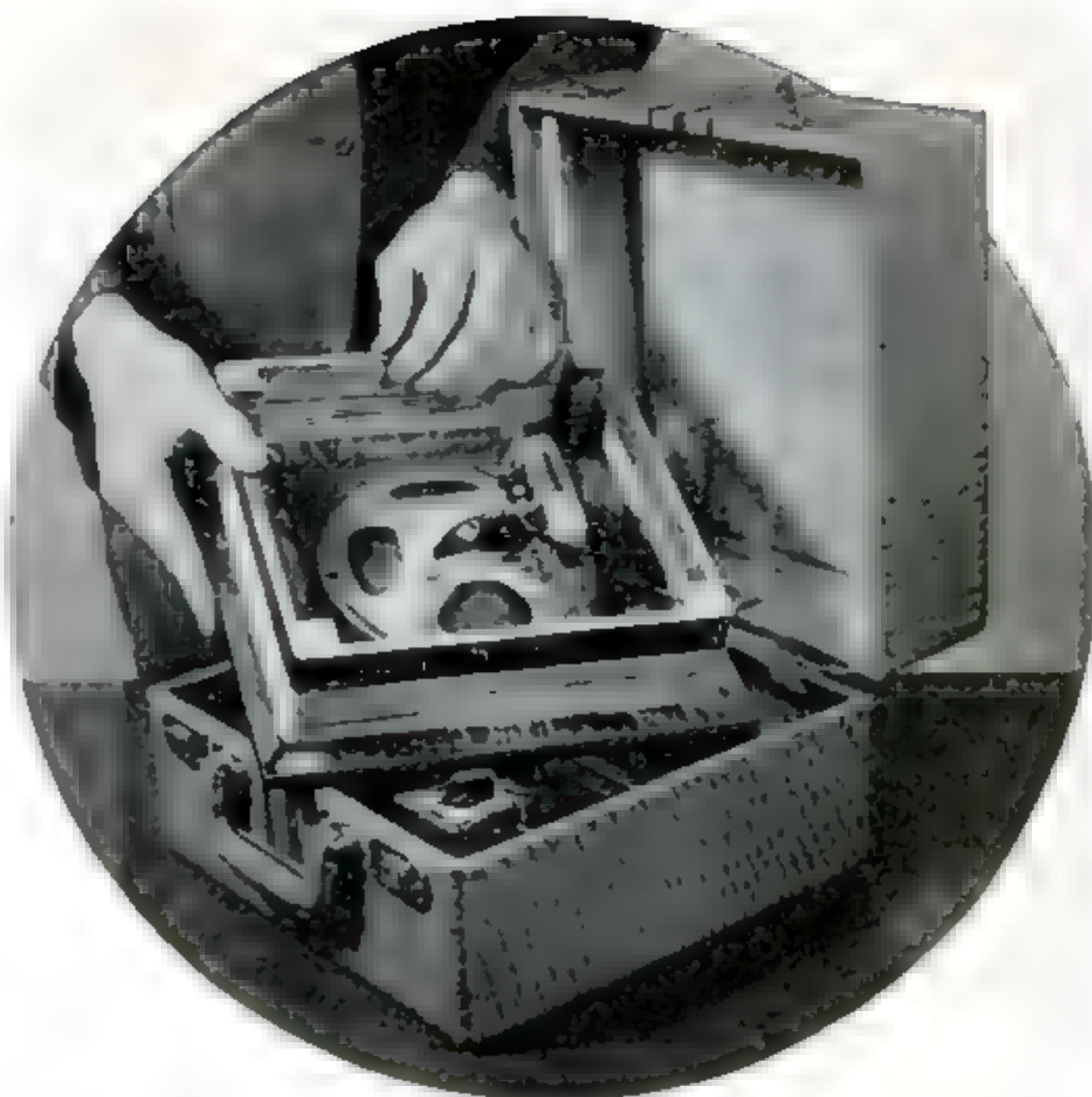
Constructed of three-eighths-inch pine and covered with attractively striped "airplane" suitcase cloth, the cabinet can be easily assembled by anyone handy with tools. If you have no tools available, your local trunk repairman or luggage shop will be glad to construct a suitable unit to your specifications. For the hinges and other hardware, rustproof metal should be used. This is doubly important if the outfit is to be used at the beach or on a boat.

As a glance at the various photographs will show, the bottom half of the case is covered with a hinged panel. This should be one-quarter inch thick and stained a dark brown. The L-shaped chassis is bolted to the lower section of this divided panel by means of the auxiliary antenna and ground binding posts. These are situated on each side of the controls and were incorporated in the circuit to make it possible to use a regulation antenna and ground when they were available.

The upper half of the panel, which covers the battery supply, should be provided with a brass ring, or some form of handle, so that it can be opened easily to allow access to the batteries.

In building the cabinet, much will depend on the selection of the parts. If the parts specified are used, the entire circuit can be mounted in a case measuring 9 by 12 by 12 inches when closed. However, if more bulky units are chosen, the dimensions may have to increase accordingly. For this reason it is best to assemble the circuit first before ordering the materials for the case.

Although the original cabinet shown in the photographs is covered with light-colored airplane suitcase cloth, leatherette or plain canvas can be used if desired.

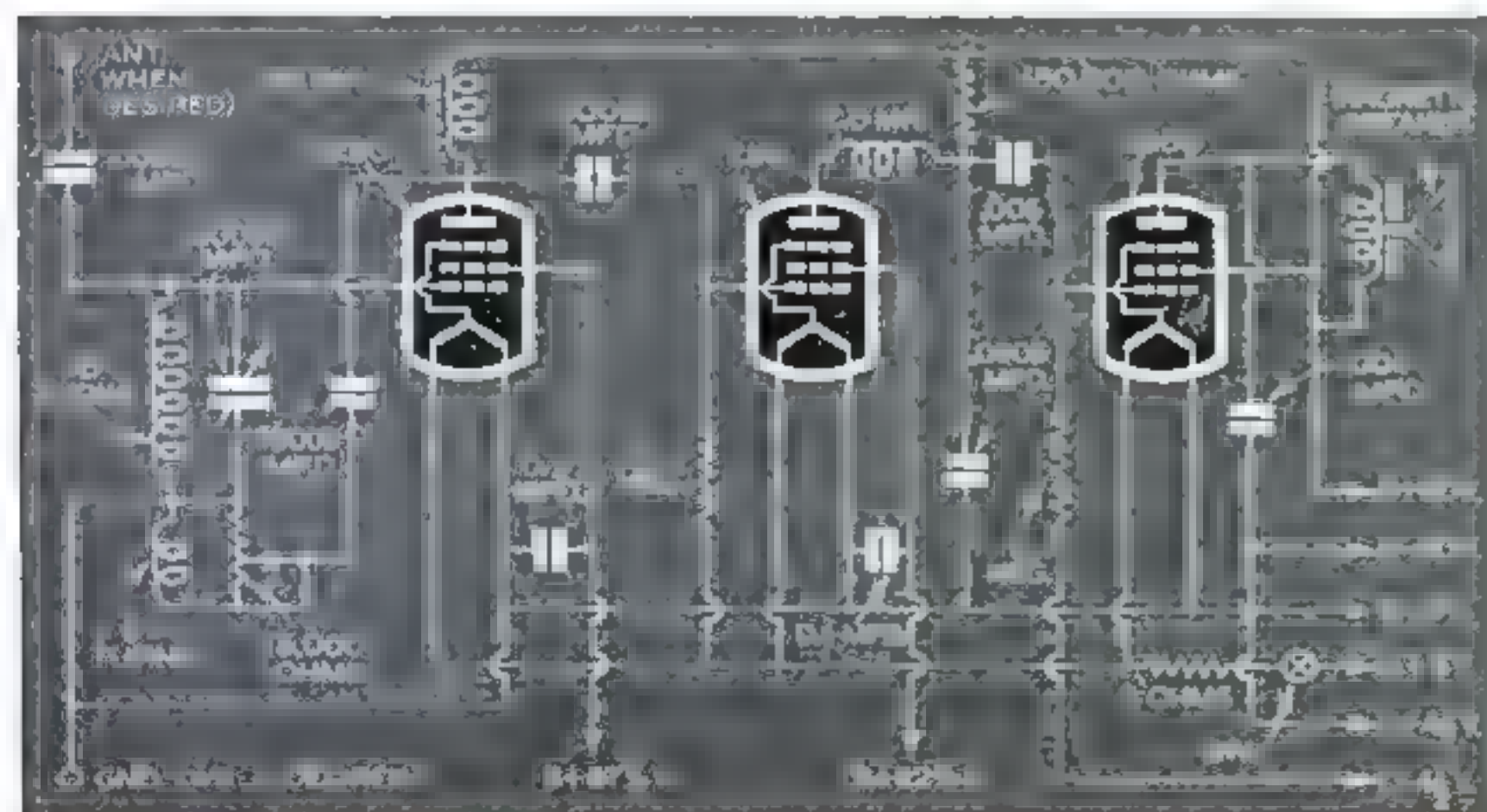


The loudspeaker and the large coil of wire which serves as the loop antenna are concealed in the top of the suitcase cabinet

### WHAT YOU NEED

Variable tuning condenser, .00036 mfd.  
Fixed mica condensers, two, .00005 mfd.  
Fixed mica condenser, .0005 mfd.  
Fixed mica condenser, .004 mfd.  
Fixed mica condenser, .006 mfd.  
Fixed mica condenser, .00025 mfd.  
Fixed tubular condensers, two, 1 mfd  
Fixed resistor, 1 meg., ½ watt.  
Fixed resistor, 2 meg., ½ watt.  
Fixed resistor, 150,000 ohms, ½ watt.  
Filament resistor, 3 ohms.  
Regeneration control, potentiometer, 15,000 ohms.  
Choke, iron core, 125 mh.  
Choke, detector plate, 2.5 mh.

*Miscellaneous.*—Batteries, chassis, cabinet, dials, knobs, magnetic speaker, tube shields, octal sockets, tubes, speaker cloth, wire, solder, lugs, etc.



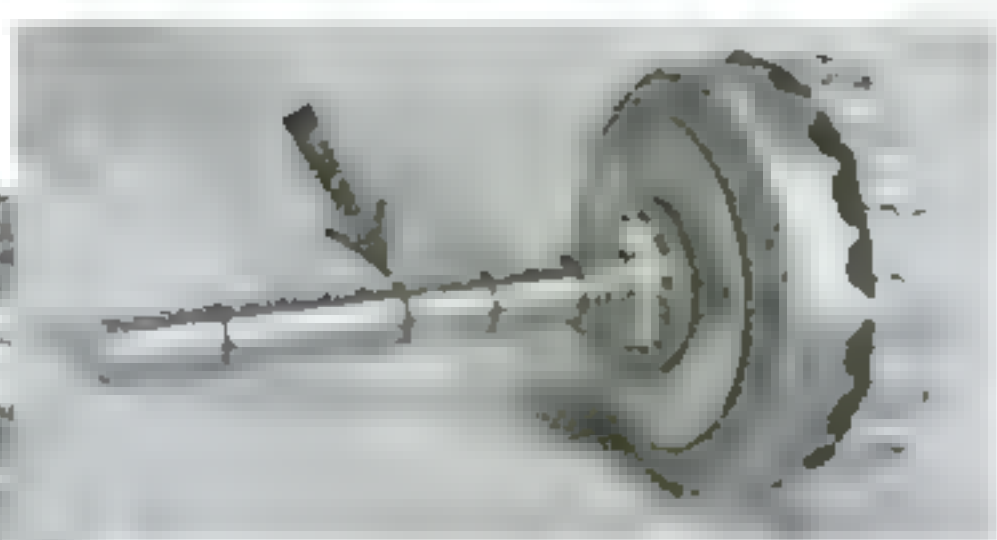
The power supply, as indicated in the diagram, is mounted above the receiver circuit. Four batteries provide the necessary current



# New Ideas for Radio Fans



Conveniently spaced notches guide the saw blade for cutting control rods to the length required

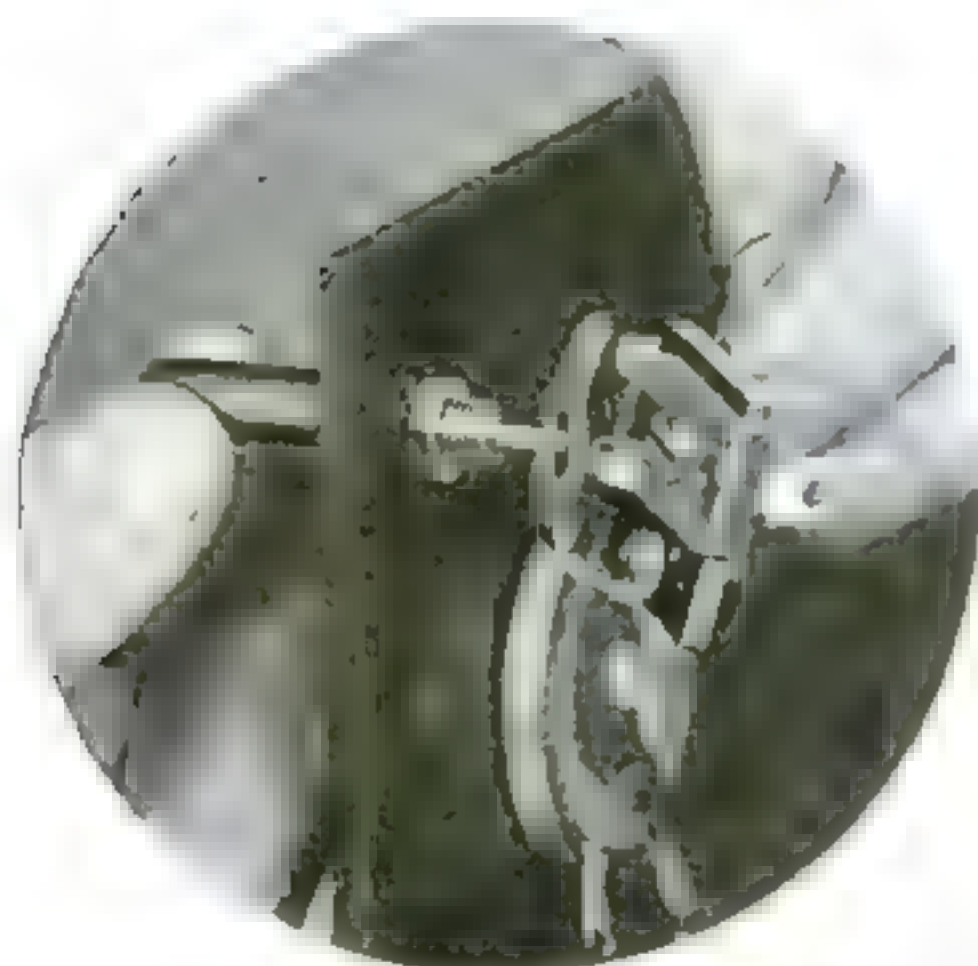


## Rheostat Shafts Are Notched for Cutting

TO SIMPLIFY the problem of cutting the control rods on potentiometers and rheostats to just the right length for panel mounting, one manufacturer now provides long shafts marked with pre-cut notches to guide the saw blade. Placed at convenient intervals, they make it an easy matter to alter the length of the shaft to suit almost any condition.

## Lock for Pick-Up Arm

IN PORTABLE electric phonographs, some means is needed for securing the pick-up arm when the outfit is being transported. One manufacturer provides the simple L-shaped bracket shown below. Mounted to one side of the turntable, the bracket engages an easily tightened bolt on the arm.

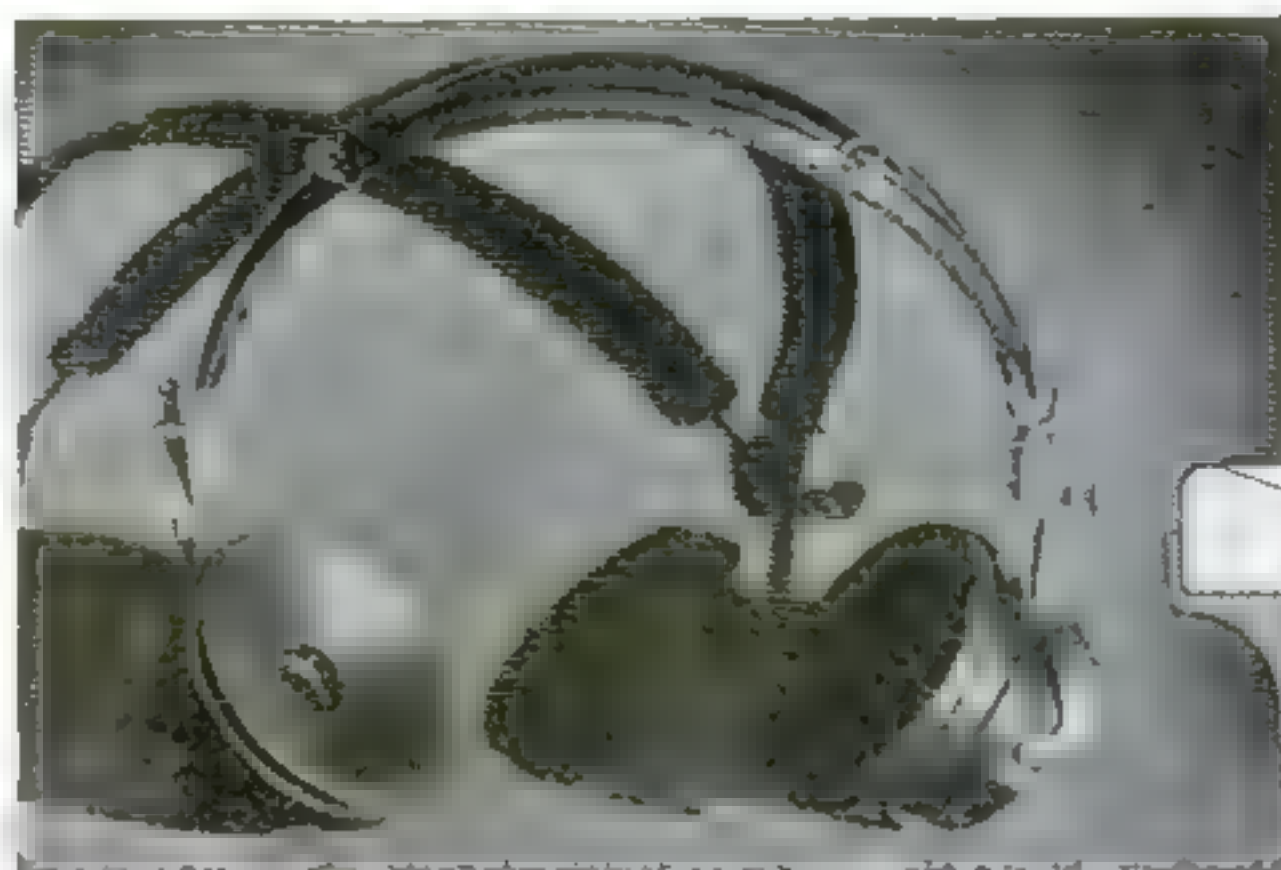
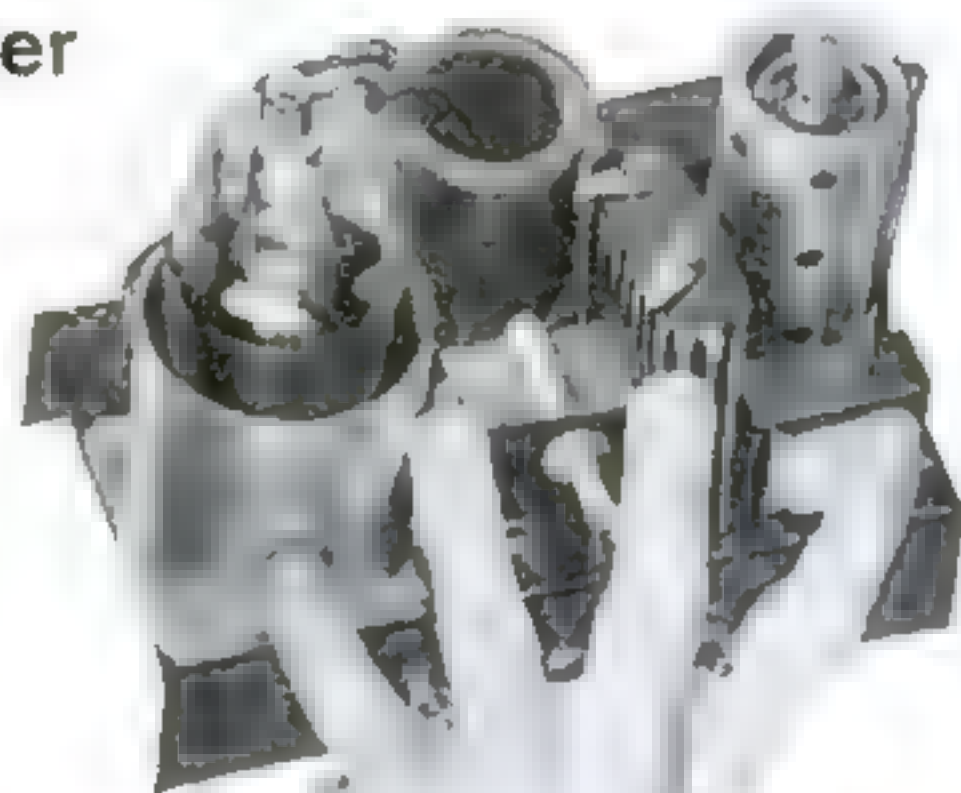


## Handy Condenser Key Made from Jack Plug

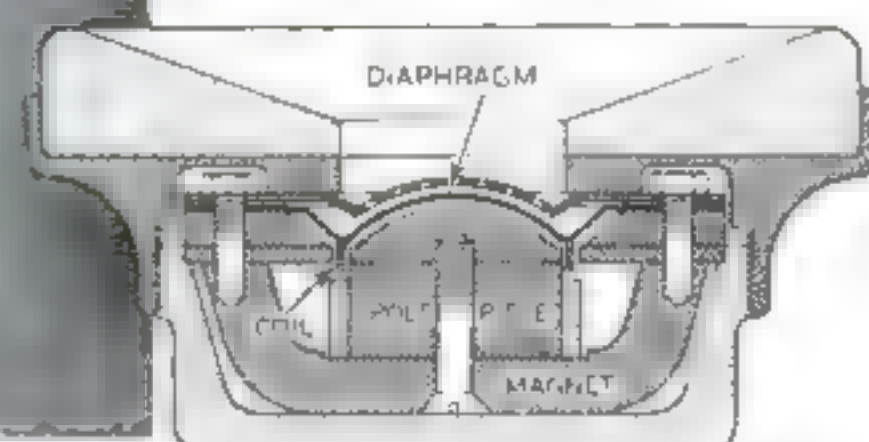
BY MOUNTING the antenna trimmer condenser of your small regenerative receiver on a pin jack as shown in the photograph above, you can adjust it easily with a homemade key consisting simply of an ordinary jack plug ground to a screw-driver point at the end. In use, the plug is inserted through the jack hole in the front panel and turned to either open or close the condenser plates.

## Midget Phone Transmitter

SMALL enough to be held in your hand, the midget crystal-controlled radio-phone transmitter illustrated at the right is especially constructed for use in small privately owned planes or boats. Said to operate over a considerable area and to provide good modulation, the compact circuit employs but two standard tubes which receive their necessary current from a vibrator-type power supply connected to a single six-volt storage battery. Plug-in coils make it an easy matter to change the circuit from one band to another.



## New Earphones Are Built Like Loudspeaker



## Transformer Is Compact

DESIGNED for use in portable circuits, a new high-fidelity, audio-frequency transformer weighs less than six ounces and takes up less space than a package of cigarettes. Provided with a high-conductivity metal case, the unit is well shielded and provides a frequency response from thirty to 20,000 cycles. The compact transformer is pictured at the left.



THE tone and quality of a dynamic speaker can now be obtained with earphones. In a new head set now available to amateurs and experimenters, a moving coil of the dynamic-speaker type replaces the conventional diaphragm-and-magnet arrangement. Because they can handle a large amount of power without rattling, the dynamic earphones are particularly valuable for the short-wave fan who prides himself on his ability to bring in the distant stations.

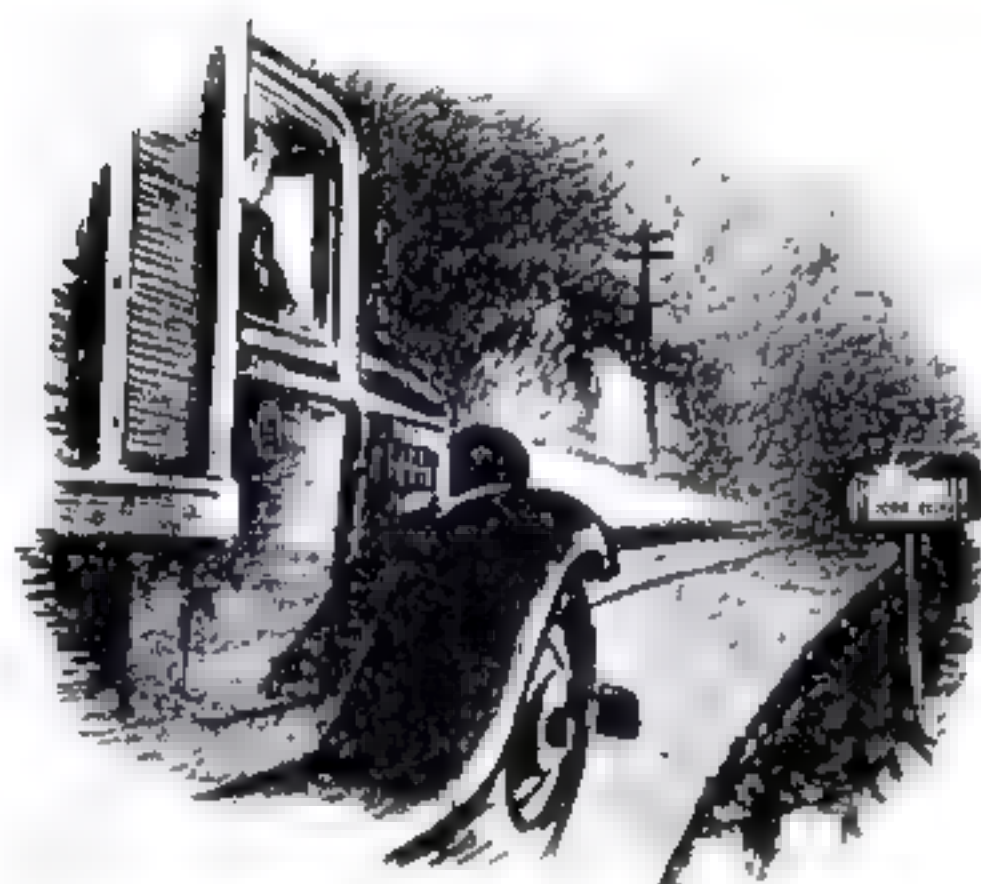


# Padlock on Gate Fools Strangers

A HUNTER or other undesired visitor who comes up to the farm gate illustrated can see at once that it is padlocked and knows he is not wanted on the property. This is quite sufficient in most cases to make him turn back. He never suspects that the padlock is merely a ruse. The farmer himself does not carry a key for it or pay any attention to it. All he does is to reach around to the back of the gatepost and undo an ordinary iron snap, which releases the chain. Two small views at the right show the front and back of the fastening.—FRED MIELKE, JR.



The padlock tells the hunter he is not wanted, but a snap on the far side really unlocks the gate



## Reflector on Mail Box Warns Trucks Away

AFTER his rural mail box had been struck several times by the overhanging bodies of large trucks that were traveling close to the edge of the highway at night, one farmer fastened a red glass reflector to the box as a warning signal. The reflector, about 3 in. in diameter, was purchased for a few cents at an auto-supply store. To prevent theft, it was welded to the mail box so it could be seen by approaching traffic.—MORRIS KATZ.

## Ice-Shaving Tool Removes Molding

THE problem of how to get the molding off window or door screens without breaking the strips, when replacing wire netting, can be solved by using an ordinary ice shaver obtainable at the ten-cent store. The prongs on the shaver straddle the nails in the screen mold as illustrated at the right. The nails may or may not be pulled out with the molding, but at least you can get the strip off whole and then easily pull the nails afterward.—T. B. OWENS.



Prongs on the shaver straddle the nails so that the strip can be pried off easily

## Inexpensive Drop Axle for Trailer Body

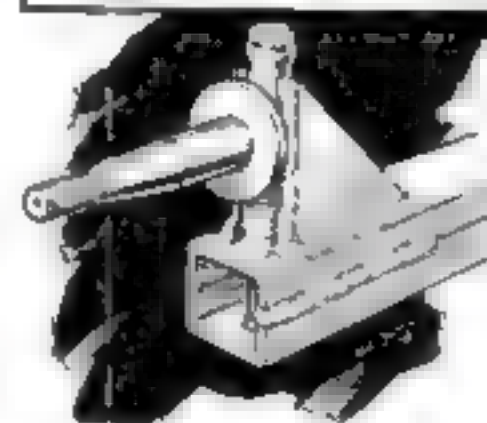
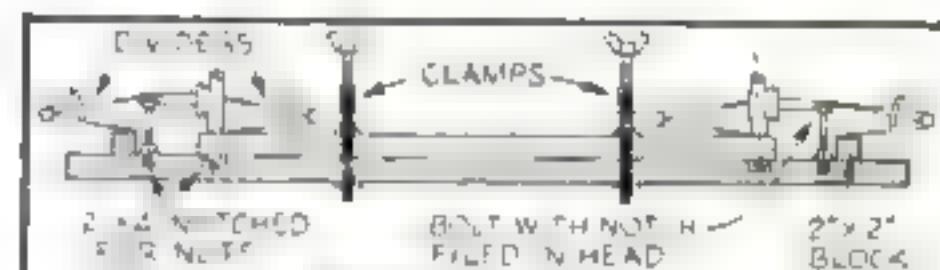
FROM materials costing little more than four dollars, a trailer axle can be constructed that is better in my judgment than the ordinary commercial axle in some particulars. The parts needed are two pieces of channel iron having a 2-in. face and 1-in. legs, four pieces of  $\frac{1}{4}$ -in. iron plate cut into right-angled triangles with both sides  $3\frac{1}{2}$  in., and two auto spindles and king-pins. I used Chevrolet spindles.

First determine the tread desired, keeping in mind that the wider the tread, the more stability and less side sway. Assemble wheel, tire, hub, and spindle to ascertain the distance from the center of the tire to the center of the king-pin hole. Then cut the channel the desired tread less twice the above distance plus  $2\frac{1}{2}$  in. Clamp channels together, legs to legs, and tack with a spot welder, if available. Drill holes through channels  $1\frac{1}{4}$  in. from the ends and  $1/32$  in. larger than the king-pin. This allows for the fact that the king-pin and spindle are not at right angles.

Assemble spindles, channels, and

king-pins, merely tightening the nuts on the latter with the fingers. Line up the spindles as shown in the sketch. Turn the nut on the bolt until the distances from lathe centers of spindle to top of channel and block are exactly the same.

Hold a straightedge alongside the assembly and as near the centers of the spindles as possible and, using dividers, make all distances from centers to straightedge the same by slightly twisting spindles on king-pins. Tighten king-pins gently and clamp the triangular plates to sides of spindles. Weld with the jig in place.—W. J. FLETCHER.

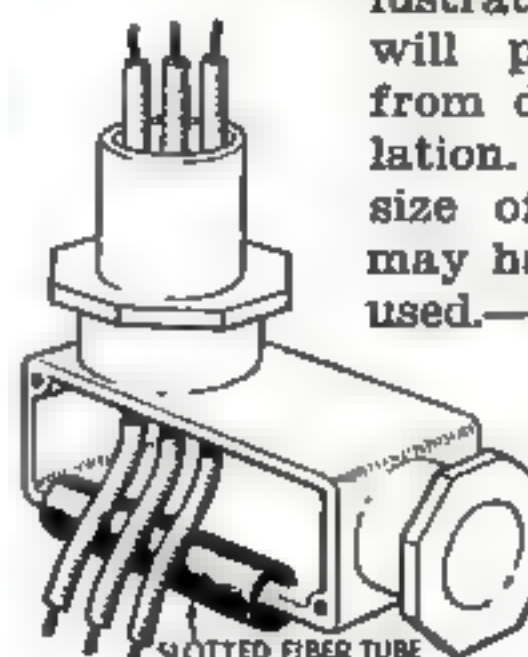


Dividers are used to line up parts accurately. Below, the finished axle



## Fiber Guard for Wiring

WHEN pulling wire or cable into the open side of a conduit fitting, a slotted fiber tube slipped over one edge as illustrated in the drawing will prevent that edge from damaging the insulation. Any convenient size of fiber tubing you may have at hand can be used.—RUSSELL M. REED.



The fiber tubing on the edge of the fitting saves insulation from damage



# YOU, TOO, CAN Photograph Children

## LIKE AN EXPERT



By REGINALD O. LISSAMAN

**P**HOTOGRAPHING children is a fascinating pastime, and it can also be made to pay good dividends. Given a fair camera and a little homemade equipment, any amateur familiar with the fundamentals of picture making should be able to turn out child story-telling pictures and portraits surpassing those of the average professional. While the amateur's results may for a time lack the finish of the expert, he can catch the spontaneity of expression that is so hard to get from a child in the strange environment of the studio.

All three accompanying illustrations were taken in my own home with purely amateur-type equipment, and while some of their beauty is due to fair technique, their attraction lies mainly, as you may see, in the beauty of expression, unposed and natural.

If you own a camera of the simpler type that permits focusing only at distances greater than six feet, you should obtain a portrait attachment. This is an auxiliary lens which slips on over the regular lens and

permits focusing as close as thirty inches. They come in both regular and diffusion types, complete with tables of distances and camera settings. While diffusion may be introduced later in printing from the negative, the diffusion obtained at the original exposure possesses a particular beauty of its own and also tends to soften some of the photographer's errors of harsh lighting. When, however, the attachment is to be used for other work as well as portraits, the regular type is the best to buy. The picture of the two children was taken through the regular attachment, while the portrait below it was taken through the diffusion type. Note the slight

The study above by Mr. Lissaman has been hung at various photographic salons, here and abroad. The data: 1/25 second at F/6.3. Four No. 1 photofloods in pairs; diffusion screens over reflectors



Portrait taken with same speed, stop, and lights, except No. 2 photoflood lamps were used. Both photos were made with an old roll-film camera, adapted to use cut film



"Quite Happy." Here the lights were at almost equal distances on either hand from the sitter. As the lights approach this position, the modeling is given flatter rendering

softening of detail in the latter picture.

The film used for this work should preferably be of panchromatic type, since even the brilliance of photoflood lamps is low in photographic light, when compared to the sun.

All the illustrations were taken with photofloods. Information and tables regarding their use are obtainable at almost any shop that sells film. The No. 2 size is more economical than the smaller No. 1 lamps. A reflector should be used. My reflectors each hold two bulbs, and I use two reflectors. Regardless of what type of reflectors you have, each should be equipped with a diffusion screen. This is made from a piece of very (Continued on page 110)

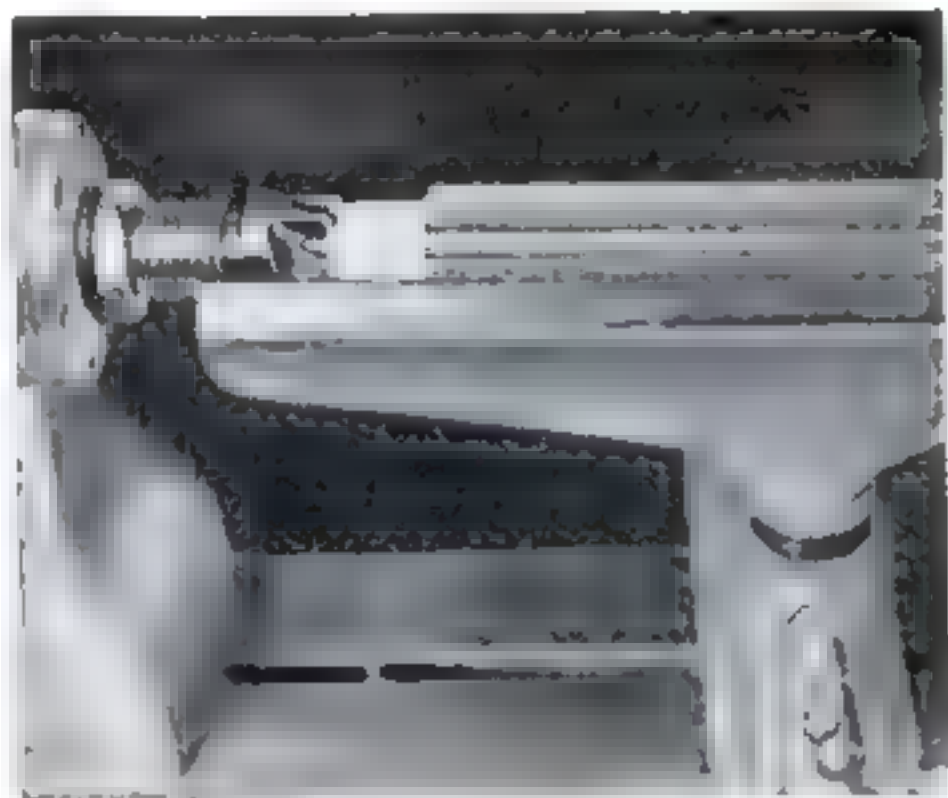


## Sleeve Wood Turning

(Continued from page 71)

sleeve block may be slipped upon the centerpiece and glued. When the glue has hardened, the sleeve is turned to size, and the procedure repeated for all the different sleeves. After the cylinder has been completed in this way, it is shaped in the usual manner.

For the construction of the small furniture bench leg used as an example, one centerpiece and two sleeves are required. These sleeves are in two sections, which are separated by a block into which the side rails fit. Another



Fluted turning ready for finishing. Note how the wood of the core has been laid bare

block of the same size is placed at the top of the turning.

The center sections of the sleeves are turned and glued first. The lower one of the blocks has a hole drilled completely through it, but the top one is bored only half of its length. Since only the most expert workers can drill these holes accurately, the blocks should be larger than their finished size. When they have been drilled, they are slipped over the end of the centerpiece and the turning clamped in the miter gauge of the circular saw, as shown. By passing the end of the block through the saw, it will be cut at right angles to the hole. With this one square side as a guide, the remainder of the block can then be cut to the required size.

The location for the lathe center in the top block can be found by drawing cross lines. The work is then assembled and glued. Before the glue hardens, it is necessary to true the rail blocks in relation to each other, so they are placed across two strips of wood on a true surface and a slight pressure is applied. When dry, the work is turned to the required pattern.

A very attractive two-tone effect can be obtained by fitting one sleeve to a centerpiece and then fluting it on a shaper. The sleeve should be thin enough to allow the cutter to lay bare the wood of the centerpiece.

## Boring Rubber Stoppers

WHEN it is necessary to bore a hole through a rubber stopper with a cork borer, time and trouble may be saved by keeping the end of the borer wet with a caustic soda (sodium hydroxide) solution.—M. C. BLANCHARD.

## YOU CAN DEPEND ON CHAMPIONS



When an outboard racing driver guns his eager, whining mount across the starting line, his hopes are firmly pinned on a few all-important factors in his engine—not least among them spark plugs—to see him first across the finish line.

Like most racing drivers who look only for the utmost in dependability and performance from their spark plugs, the champions of outboard racing, almost without exception, use Champions exclusively. Douglass C. Fonda, sensation of the 1937 outboard racing season, achieved a record such as has never before been compiled by a single driver in one year. Winner of three national awards, he always uses Champions "because of their absolute dependability."

Every engine, whether automotive, aircraft, marine, truck, tractor or stationary,

will perform better with Champion Spark Plugs. 27 years of ceaseless engineering and research, devoted exclusively to the constant betterment of the one product manufactured by Champion, have made this a fact. Demand Champions for your car because you can depend on them. Wherever you find good service you will find a Champion dealer.

### Champion "V" Spark Plugs



$\frac{3}{8}$ " 24 Thread  
Actual Size, 65c

Specially designed for model gas engines giving the same dependable performance as regular Champions. Absolutely gas-tight, alloy needle point electrode, one-piece construction. If not available through your dealer, write Champion Spark Plug Company, Toledo, Ohio.

**CHECK AND CLEAN SPARK PLUGS WHEN YOU CHANGE OIL**



# UNRULY HAIR

*Stays Neatly Combed*



**Even Stubborn Hair Will  
Stay In Place**



**Costs But A Few Cents To Use  
— a bottle lasts for months**

**I**S YOUR HAIR difficult to keep in place? Does it lack natural gloss and lustre? It is very easy to give it that rich, glossy and orderly appearance so essential to well-groomed boys.

Just rub a little Glostora through your hair once or twice a week — or after shampooing, and your hair will then stay, each day, just as you comb it.

Glostora gives hair that natural, rich, well-groomed effect, instead of leaving it stiff and artificial looking as waxy pastes and creams do.

Try it! A large bottle of Glostora costs but a trifle at any drug store.



**Glostora**

## Workshops Started by Guild Clubs

(Continued from page 78)



Mexico (Mo.) Homcraft Club with projects and tools that formed part of an exhibit

demonstrations, literature, and special services. Fourteen percent of the clubs meet in hardware stores. The largest number (forty-one percent) meet in members' homes. Although fifty-one percent stated women sometimes attend, only thirteen percent have women members.

There is, however, one club composed entirely of women—the *Gila* (N. Mex.) Homeworkshop Guild. It was organized last fall by twelve women who met at the home of Mrs. Arthur Northrup. Mrs. Northrup is president; Mrs. Adrian Bumgardner, vice president; Mrs. A. L. Barnett, secretary-treasurer. Sixty children were given toys and candy at Christmas.

The Staley Handicraft Club, *Decatur, Ill.*, is growing rapidly. Ten members joined at one meeting, bringing the total membership to more than seventy.

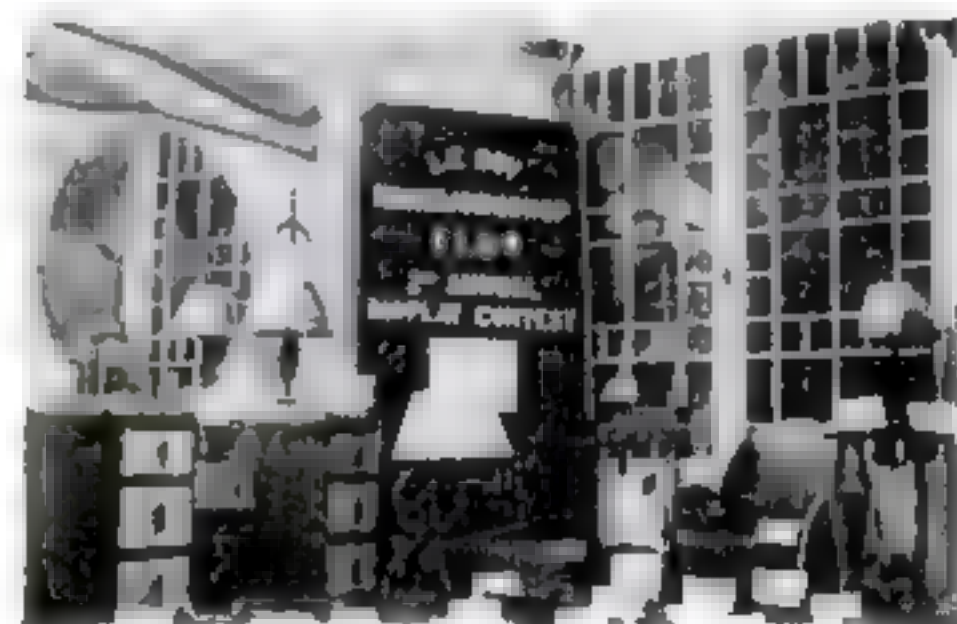
A junior auxiliary is being organized by the *Montgomery* (Ala.) Handicraft Club . . . Three members of the *London* (Ont., Canada) homeworkshop Club are making their own lathes . . . President Earl Scothorn demonstrated how to use the jig saw and wood-turning lathe for the Fort Stanwix Hobby Club, *Rome, N. Y.* . . . The Build-Our-Own Homeworkshop Club, *Natrona, Pa.*, is installing a club workshop in a garage.

Charles Krause was host to the *Saginaw* (Mich.) Homcraft Club in his workshop. New officers are C. S. Kolb, president; Merle Hedrick, vice president; L. E. Foglesong, secretary; Ernest Deford, treasurer; William J. Klenke, librarian. T. J. Paquette, George Parent, and the officers form the board of governors . . . Demonstrations of making wooden statuettes, shaping oval picture frames, and upholstering were given at a meeting of the *Oklahoma City* (Okla.) Homeworkshop Club . . . The *Toledo* (Ohio) Homeworkshop Club was formed recently at the home of H. E. Stalker. The second meeting took place at a hotel, and various types of craftwork were exhibited . . . A total of 250 toys were made by the *St. Joseph* (Mo.) Homeworkshop Club and turned over to the Boy Scouts for distribution. New officers are W. F. Simmons, president; Ray Harvey, vice president; Hartlie O.

Davis, secretary-treasurer; Everett Elkins, librarian.

After incorporating last summer, the *Leroy* (N. Y.) Homeworkshop Club purchased an old house, which at present is being remade into a club workshop and an apartment. There were 39 entries, 13 more than last year, in the club's second annual exhibition.

Officers of the *Chaska* (Minn.) Homeworkshop Club are William Betchel, president; Arnold Lambrecht, Jr., secretary; Oliver Rekow, Jr., treasurer . . . Charles Johnson demonstrated pottery making and A. W. McIntosh finished a sundial in bronze before the *Mazda* Homeworkshop Guild, *Euclid, Ohio* . . . Although most clubs are interested in woodworking, the *Hardwood* Homeworkshop Club, *Neenah, Wisc.*, reports that by the end of this year at least eighty-seven percent of the members will own metal-working machinery . . . The *Shenango Valley* Homeworkshop Club, *Sharon, Pa.*, is conducting a membership drive . . . A great deal of interest in the home workshop hobby was created by a display



Annual exhibit of the LeRoy (N.Y.) Homeworkshop Club in a hardware store window

of the *Mexico* (Mo.) Homcraft Club in a local hardware store . . . New officers of the *Yakima* (Wash.) Homcraft Club are Everette R. Small, president; A. J. Stephens, vice president; R. L. Mashburn, secretary-treasurer; Earl C. Brown, librarian . . . The *Witch City* Homeworkshop Club, *Salem, Mass.*, is specializing in building models.

The *Niagara* Homeworkshop Club, *Niagara Falls, N. Y.*, has purchased a screw-cutting lathe for its club workshop. Officers are K. Gifford, president; R. Klettke, vice president; H. W. Stegman, secretary; W. Klettke, treasurer; D. Romberg, librarian.

Theodore F. Herbert has been elected president of the *Gem City* Homeworkshop Club, *Dayton, Ohio*. Other officers are George Sanders, vice president; Victor R. Shuttleworth, secretary-treasurer; Lesley Armstrong, sergeant-at-arms . . . Projects made by members of the *Ware* (Mass.) Homeworkshop Club in one month include the following: Plaque of Guild emblem, made by E. Gosselin; canary breeding cage, R. Bouvier; serving tray, L. Mozdzierz; model of circus wagon, Thomas Moriarty . . . The Homcraft Club

(Continued on page 99)



## Clubs Start Workshops

(Continued from page 98)

of Pittsburgh, Pa., has increased its membership to 348 men . . . A clam boil was held for members of the Timber Craft Homeworkshop Club, New Bedford, Mass., and their wives recently.

Members of the Bison Homeworkshop Guild, Buffalo, N. Y., are remodeling the newly acquired clubroom and making furniture for it. John P. Cleary lectured on aluminum recently. The club delivered 475 toys to 128 families last Christmas.

W. T. Baxter, art metal and jewelry instructor at Woodrow Wilson High School, Washington, D. C., demonstrated gem cutting and jewelry making for the Capital Homecraft Club. The annual exhibit was held in February . . . James Arnish has been elected president of the Sunset Social and Hobby Club, Brooklyn, N. Y.; Bennie Amodeo, secretary; Robert Bahlin, treasurer . . . Under the direction of Gladfred Viery, the Niles (Calif.) Homeworkshop Club entertained the Arts and Crafts Club. An exhibition was held in March . . . The Fall River (Mass.) Homeworkshop Club plans to hold its annual exhibition in June . . . Talks on hardwoods, operation of the table saw, and inlaid pictures were given at a recent meeting of the Seattle (Wash.) Homeworkshop Club . . . Officers of the Peekskill (N. Y.) Homeworkshop Club are Herman MacPeck, president; Lester D. Jessup, vice president; Harry Rigby, Jr., secretary; Arthur A. Dix, treasurer. The annual exhibition was held in March . . . A survey of the Ware (Mass.) Craftsman Guild shows that nearly half of the members own power equipment.

Recent meetings of the Tri-City Homeworkshop Club of LaSalle, Peru, and Oglesby, Ill., have included talks by J. C. Rucinski on leather work and Paul Repka on plastics . . . The Edison Homeworkshop Club, Chicago, Ill., has completed plans for its annual craftsmanship contest on April 21 . . . Officers elected by the Fargo (N. Dak.) Homecraft Guild are Arthur Malme, president; J. L. Woodward, vice president; John C. Pollock, secretary-treasurer; Gunnar Helland, librarian; Leland Patten, governor for three-year term.

The Y. M. C. A. hobby show of which the Lincoln (Nebr.) Homeworkshop Club was cosponsor was so successful that hereafter the club will sponsor it. There were 134 exhibitors with 283 items entered. Approximately 2,000 persons attended. The members have completed their ottomans and are taking up archery this spring.

## How to Start a Club

COMPLETE information on how to start a home workshop club in your neighborhood is yours for the asking. Address the National Homeworkshop Guild, 347 Fourth Avenue, New York, and inclose a large (legal size), self-addressed, and stamped envelope.

# OL' JUDGE ROBBINS

AT COLONIAL WILLIAMSBURG, VIRGINIA

HOW COULD ANYONE SAY THAT? I'VE BEEN AGING LONGER THAN THE FREE REVOLUTIONARY DAYS!

WELL, FOR ONE THING, THEY WERE LIVED BY REASONS. AS FOR THE OTHER, IT'S A FACT OF THE PAST THAT WE'VE LIVED BY REASONS.

THESE MUSEUM EXHIBITS WERE DUG UP FROM THE RUINS OF BUILDINGS DATING AS FAR BACK AS TWO CENTURIES.

HERE'S AN INTERESTING CASE, DAD!

IT'S HARD TO BELIEVE THAT A WHOLE DINNER SET COULD BE RECREATED FROM THOSE SMALL FRAGMENTS OF CHINA. BUT THAT'S WHAT WAS DONE. EVERY PEARL OF EARTH WAS CAREFULLY SIFTED.

REPRESENTATIONS OF COLONIAL SILVERWARE

AN EXCITING FIND WAS A SMALL SILVER COFFEE SPOON THAT GAVE THE KEY TO A COMPLETE COLONIAL SILVER SERVICE.

THESE CURIOUS 'H' AND 'V' HINGES ARE VERY POPULAR NOW. THIS PANEL SHOWS REPLICAS OF SOME FOUND ON THE SITE OF THE GOVERNOR'S PALACE.

I RECOGNIZED YOU, JUDGE ROBBINS. WHAT DO YOU THINK OF THIS CHURCHWARDEN PIPE? IT WAS DESIGNED FROM A PIPE BOWL FOUND IN THE DIGGINGS.

VERY INTERESTING. THAT LONG STEM TELLS THE STORY OF HOW THEY TRIED TO GET A COOL SMOKE IN THE OLD DAYS.

WELL, NOWADAYS WE HAVE A BETTER WAY TO KEEP OUR SMOKE COOL AND MELLOW. EH, JUDGE?

I SHOULD SAY SO. PRINCE ALBERT CERTAINLY HAS SOLVED THE PROBLEM OF GETTING A MILD, COOL SMOKE!

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**THEY'VE ALL FOUND THE KEY TO  
MORE SMOKING JOY!  
—A Milder Pipe Tobacco That's Tastier Too!**

**RICH TASTE**  
COMES FIRST WITH  
**ME. PRINCE ALBERT IS**  
**FULL-BODIED, YET**  
**NEVER HARSH**

**TRAINMAN**

**I CAN PAY THE**  
**PRICE OF ANY TOBACCO,**  
**BUT PRINCE ALBERT HITS**  
**ME RIGHT FOR MILDNESS**  
**—IT'S NO-BITE**  
**TREATED!**

**CONTRACTOR**

**I FIGURED**  
**OUT WHAT ASSURES**  
**BETTER PACKING AND**  
**DRAWING AND**  
**MELLOWER SMOKING.**  
**SO I SWITCHED TO P.A.**  
**—IT'S CRIMP CUT**

**SCIENTIST**

**BETTER—OR  
IT'S OUR TREAT!**

Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage. (Signed) R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

# PRINCE ALBERT

THE NATIONAL  
JOY SMOKE





## HOW A SIMPLE TRICK MAKES SHAVING EASY

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● A few passes whisk away Blackstone's steel-gray stubble quickly and cleanly. You don't have to be a magician to duplicate this feat. Simply use a Gillette Blade in a Gillette Razor. You'll get the world's best shaves for less than one cent a day.

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New Brushless  
Shaving Cream

Prepare your beard for perfect shaves with Gillette's New Brushless Cream. Made with peanut oil, it softens wiry whiskers, stays moist, speeds shaving, won't clog your razor. Try a tube. You'll like it!

**LARGE TUBE ONLY 25c**

**LESS THAN 1¢ A DAY**  
buys the world's finest blade

PRECISION MADE FOR EACH OTHER

**Gillette**  
*Blades*

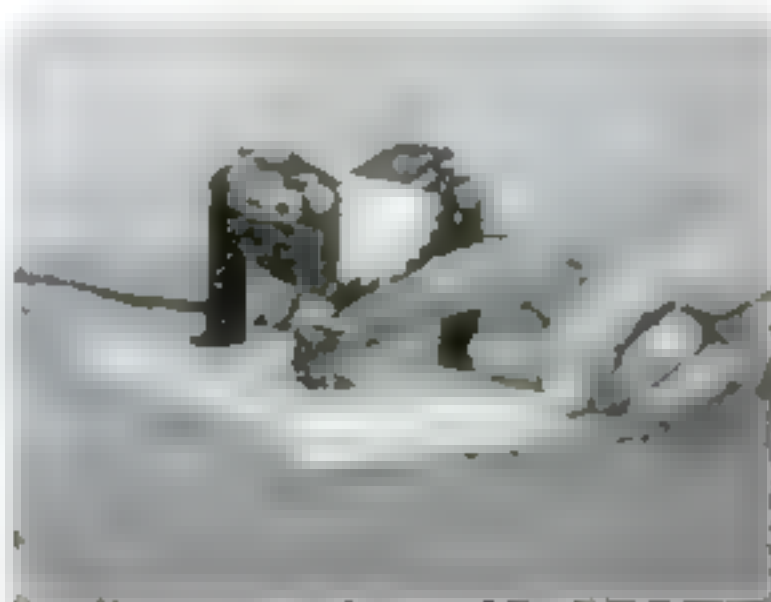
MORE SHAVING COMFORT FOR YOUR MONEY

# SMALL "GROWLER" Armature Tester

wound on core from old auto generator

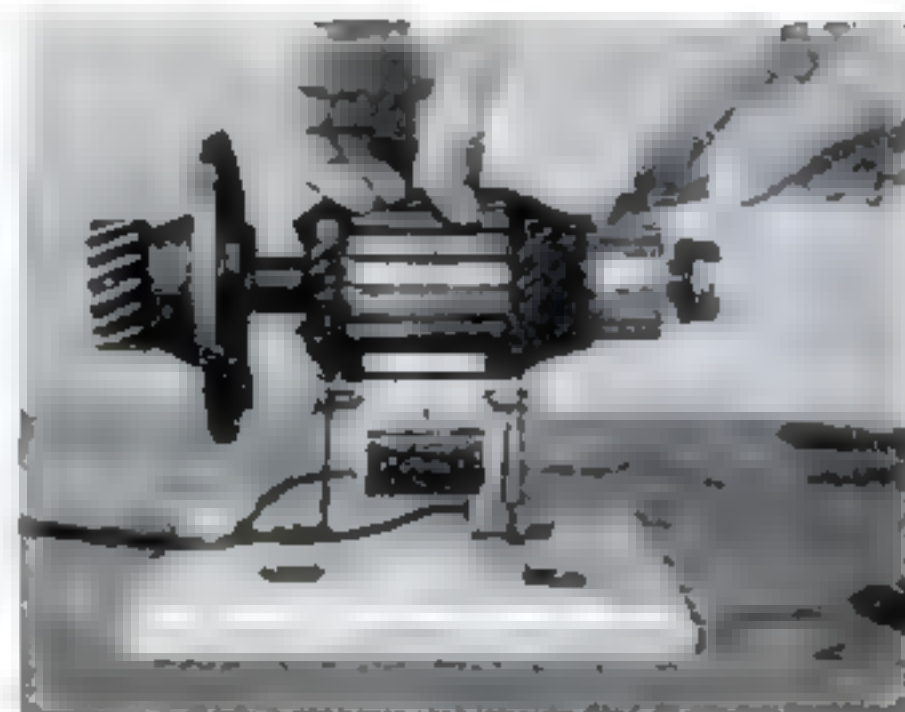


FIG. 1



The laminations from an old auto generator are cut and stacked on metal dowel pins

At left, the test unit completed, showing position of toggle switch on one of the legs of the instrument



How an armature is placed on the tester and a metal feeler used to locate an open circuit

way while the winding is done, they must be left off until later.

Replace the fiber insulating strips in the slots and wind the core. This is done with No. 22 or 24, B. and S. gauge, double cotton-covered wire. About 300 turns will be enough, and they should be distributed as evenly as possible in the slots between the clamp bolts. Do not let the wire hump up above the central hole so that an armature being tested will rest on it. It may be necessary, in

case larger wire than No. 24 is used, to substitute thin oiled or varnished paper for the thicker fiber strips. In any case, use some kind of insulation between the core and the windings.

The legs are formed from rather heavy gauge steel strap. Mount the unit on a wooden baseboard with screws. A line switch is also required. It may be of the toggle type, mounted in a 1/2-in. hole in one of the legs.

As the method of using an armature tester is rather well known, it will be

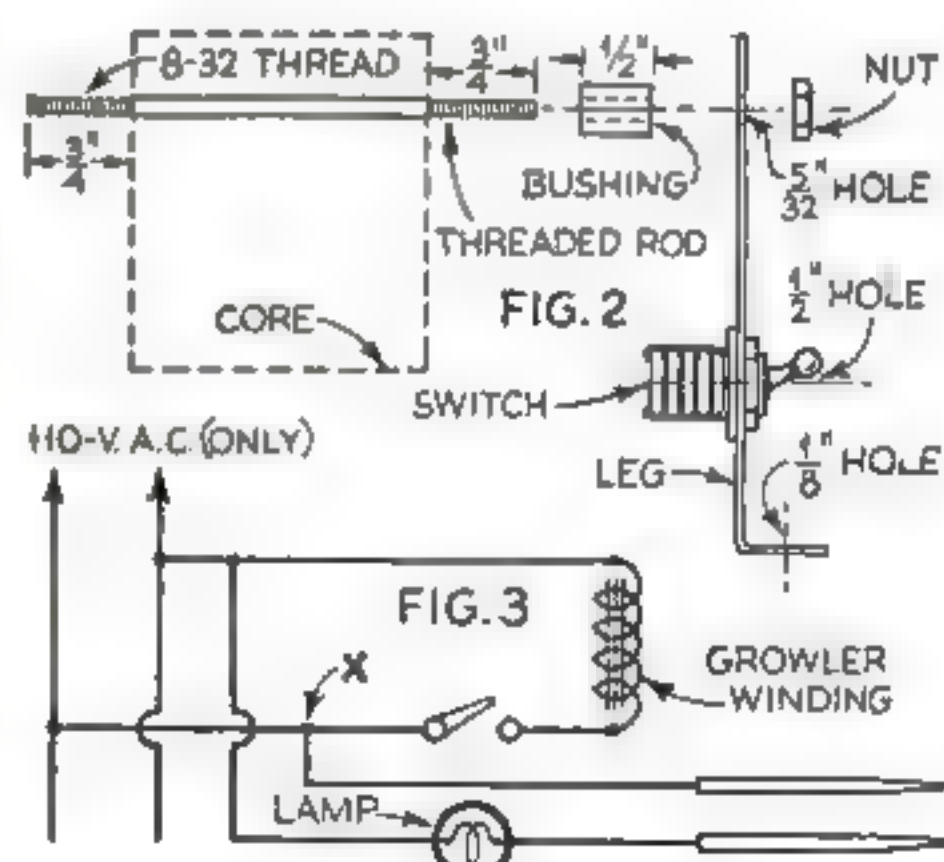
**W**ITH this armature-testing unit or "growler," it is a simple task to find the reason for the sluggish operation of an auto generator, starting motor, electric drill, or any small commutator-type shop motor.

The growler core is made from the armature core of a discarded auto generator. Remove the coils from the core, drive out the shaft, slip out the fiber insulating strips in the slots and, with a pair of tin shears, cut away about one third of each lamination, leaving the part to be used in the final assembly like those shown in the drawing above. The fiber end pieces should also be cut to this shape.

A good form to use in reassembling the laminations consists of two long metal dowels driven into a board (Fig. 1). Put one of the fiber end plates in place first and follow up with all the steel laminations, ending with the other fiber plate.

Take the assembly from the board, bringing the dowels up with it, and clamp in the vise. Remove the dowels and put in their places two lengths of steel or brass rod, threaded on each end with an 8-32 die. These rods, shown in Fig. 2, should be 1 1/2 in. longer than the assembled core.

Make four metal bushings, 1/2 in. long, place them over the protruding ends of the rods, and apply nuts tightly to keep the laminations from spreading. These nuts will have to be removed after winding so that the legs of the tester can be applied, but as the legs would be in the



X-CONNECT TEST LEAD ON LINE SIDE OF GROWLER SWITCH AS GROWLER IS NOT ENERGIZED WHEN LAMP IS USED

Wiring diagram of growler, test prods, and lamp, and, above, the front leg and switch



mentioned only briefly. Additional information can be obtained, when required, in an automotive manual or from your auto mechanic.

The armature is placed over the pole faces of the unit and the current turned on. This causes the familiar hum or growl which gives rise to the name of this type of tester. Hold a thin steel strip, such as a hack-saw blade, over the armature coils and slowly rotate the armature with the other hand.

If the blade is attracted strongly to the armature at some certain position, it indicates that the coil directly between the pole faces is shorted. If this is the only place where the attraction takes place, it means that the short is between two or more turns of this one coil. If, however, the feeler is attracted by two or more coils, one of these coils is very probably shorted by the other.

The feeler is also used to test for an open-circuited coil. One of the photographs shows this test being made on a generator armature. Use the feeler to short-circuit adjacent bars around the commutator. If, on breaking the contact, a heavy spark is noted, pass on to the next pair, as the spark indicates a closed circuit; otherwise look for a break in the coil connected to the bar.

Grounds between coils and core sometimes occur. To test for these, a pair of test prods and a lamp are needed. These were not incorporated in the unit made by the writer, but may be added to the baseboard if desired. The wiring diagram (Fig. 3) shows how they are connected. In this test, the growler switch is turned off and the test lamp circuit used alone. One prod is held on the armature shaft while the other is touched to each commutator segment in turn.

There are two armature faults that are hard to detect. Sometimes the heat developed in running will cause a short in an armature, and when placed on the growler for test will show clear. The time taken up in removing the armature from the machine and placing on the unit will be enough for the armature to cool off and clear up the fault. Obviously, heating the armature just before testing is the method to use in a case of this kind. Then again, the centrifugal force exerted on the coils while running may cause a short that doesn't show up in a stationary test.

As a final word, don't turn on the "juice" before putting the armature in place, and always turn off the switch before removing it.

### Brass Ring Aids in Making Ground-Glass Screens

FOR photographic and experimental purposes, a piece of ground or frosted glass is often required. Here is a quick and easy method to prepare it: Obtain a heavy brass ring about 1 in. in diameter with about a ½-in. hole, although the dimensions are not important. Place it on the sheet of glass and put a small quantity of powdered abrasive inside the ring. Add water to make a thin paste and start grinding by moving the ring in small circles. More abrasive and water must be added from time to time when you feel an adhesion between the ring and the glass.

For an extra fine-grain screen to use with your microscope, start with a coarse grit and grind until you remove the polish; then wash the glass and ring thoroughly and use a finer grit for finishing. The best abrasive for the finer screens is regular optical emery, grit No. 303 being satisfactory.—J. E. G.

# New Principles in Hearing Aids



**WESTERN ELECTRIC'S** new Audiphone is not just an improved version of an old model. This Ortho-technic Model is brand new—built on *entirely different principles* in hearing aid design that bring you hearing ease impossible till now!

Developed by scientists at Bell Telephone Laboratories, this remarkable instrument at last enables you to **Hear clearly** and enjoy group conversations once more; **Hear in any position**—there's no "cut-off" when you lie down or recline;

**Widen your hearing circle**—hear distinctly at much greater distances;

**Enjoy natural tone**—with greater volume than in any previous aid;

**Reduce bother and expense** in connection with batteries—they last much longer.

A variety of combinations enables your dealer, after an Audiometric test, to recommend a hearing aid—with either air or bone conduction receiver—that will meet individual requirements. Send the coupon today for booklet giving full details.

**THE NEW**  
*Western Electric*  
**HEARING AID**  
Ortho-technic Model

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Please send details on New Western Electric Audiphone (Ortho-technic Model) and name of nearest dealer.  
PB-35

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Address.....

City.....State.....



**I'LL FIX THAT  
IN A JIFFY!**



## Canned Wood Makes Home Repairs Easy

Anybody can do a fine job of repairing quickly—

- broken chairs
- loose casters
- holes in wood
- nicks
- cracks
- screw holes
- loose drawer pulls, etc.

with this canned wood that handles like soft putty and quickly hardens into wood you can drive nails and screws into, paint, or carve. Paint, hardware and 10¢ stores sell **PLASTIC WOOD** in

10¢ and 25¢ tubes, 35¢ cans.



**PLASTIC WOOD**

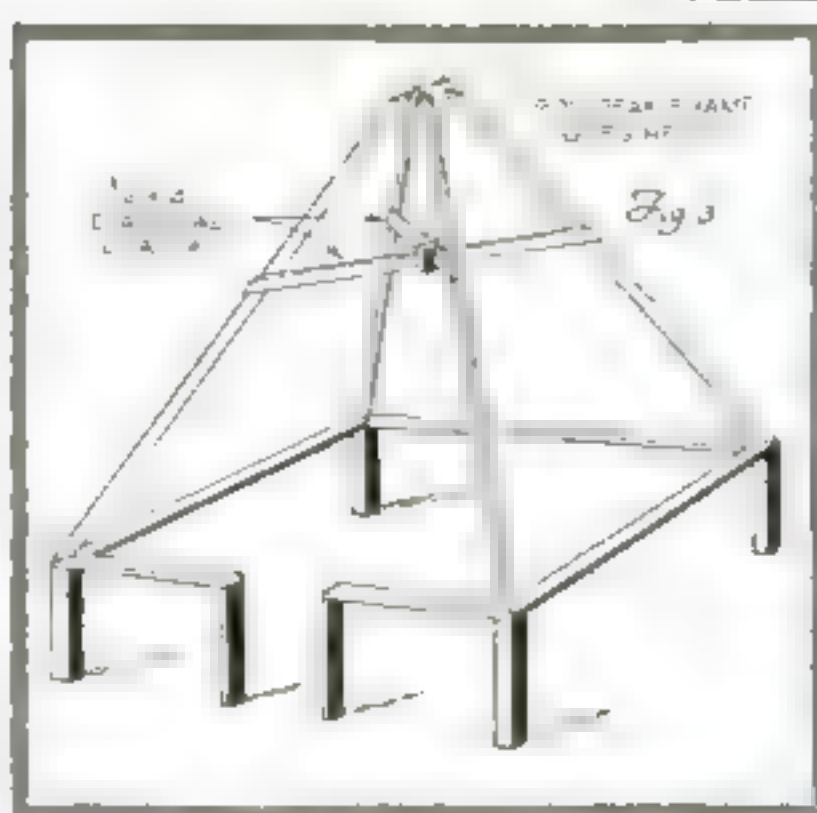
**HERE'S THE  
MASTER  
FIXER**



Quickly, permanently joins and repairs china, glass, wood, celluloid, etc. It's Transparent—yet sets like granite.

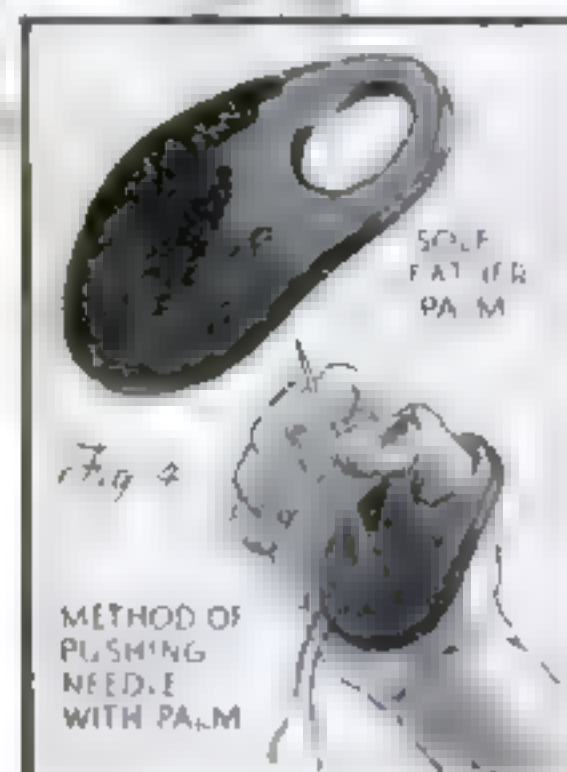
Also available in Metal color. At paint, hardware, 10¢ stores.

**Old English  
CEMENT**



Smoke flaps in use and, above, the best frame

## Heating a Square Tent ON CHILLY DAYS



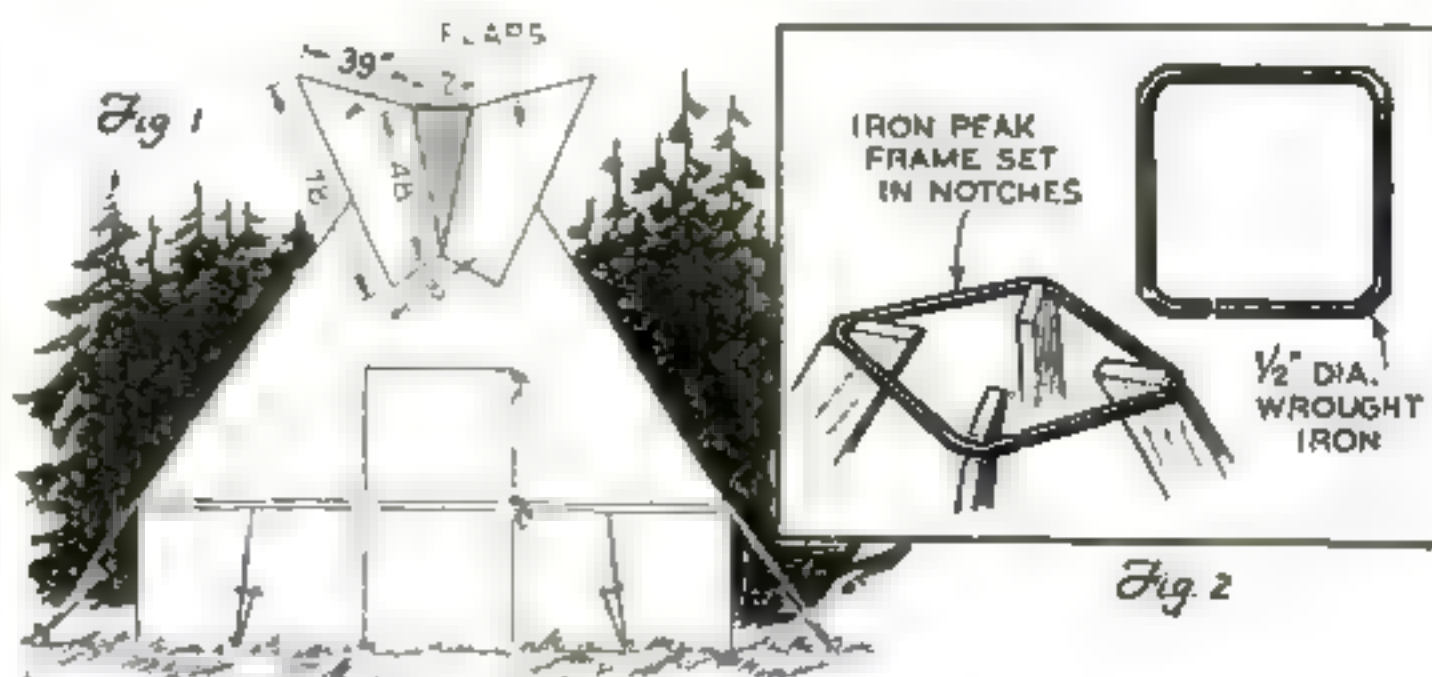
**I**F FITTED with smoke flaps like a teepee, an ordinary square Sibley tent can easily be heated for early spring and late fall camping, and the cooking can be done in comfort under cover. Besides, your firewood is always dry, less wood is required, and light as well as heat is provided by the fire.

A triangle is cut out of the front of the tent as shown in Fig. 1, and the flaps are sewn on. Cut, hem, and fit small pole pockets into the upper corners of the flaps before hemming the flaps themselves; then turn the hems of the flaps over the edges of the pockets, and sew all together securely when hemming the flaps. A palm protector made as in Fig. 4 will aid in sewing the heavy cloth.

While it is possible to use a center pole with this arrangement if the foot of the pole is covered with asbestos and the fire is placed a trifle forward of the center of the tent, it is more satisfactory to make a frame. The best arrangement is shown in Fig. 3, made with fir "two by fours" and  $\frac{3}{4}$  by 4-in. boards for the diagonal bracing. If the corner and door posts are sunk firmly in the ground, the diagonal bracing may be omitted. Should lumber be difficult to get, four corner pieces alone will serve, if the X-shaped cross bars are placed about 6½ ft. from the ground. In either case, the poles are notched at the top (Fig. 2) to receive the iron rod sewed into the top of the tent.

The knack of handling the fire must be learned by experience. The force of the draft is controlled by raising the windward sod cloth. The tent door must be kept closed.

In a teepee, the beds are usually placed at the back. Cooking utensils and provisions are arranged on one side; firewood and equipment on the other. Hangers are strung to the poles for clothing.—J. H.



Size of flaps and how poles are notched to fit rod in top of tent



## This Racing Yacht Won a Championship

(Continued from page 75)

the keel. Do the same with opposite side, the latter plank being lapped over the first plank at keel and trimmed so that edge will be at center of keel. Trim overlap with a razor blade and fill with seam composition. Apply one coat of shellac or paint to inside of hull. Attach deck, applying seam compound, then sandpaper and shellac. Finish hull with stain and three coats of varnish.

To make lead keel, first cut a wood pattern to shape. Saw a slot  $\frac{1}{2}$  in. deep in upper end and fit 20-gauge galvanized iron  $\frac{3}{4}$  by 9 in. into slot. Varnish pattern. When dry, apply thin oil, and set on oiled glass in upright position as shown. Surround with a wooden frame and pour thick mixture of plaster and water in one side. When plaster has set, trim off portion that has flowed to other side; then oil the surface of the plaster and pour the second half. Separate the halves and remove wood pattern and metal. Dry over a stove for three hours, set in a box of sand, put the metal slot former in position, and cautiously pour melted lead into mold. It is dangerous to pour hot lead into a damp mold because of the possibility of an explosion. When cool, remove lead from mold, take out the metal strip, and smooth the casting.

(Continued on page 105)

### LIST OF MATERIALS

#### WHITE PINE

No. Pc.	T.	W.	L.	For
1	$\frac{3}{4}$	8	31	Work board
1	$\frac{3}{4}$	4	28	Keel, stem, and stern
1	$\frac{1}{4}$	6	32	Topside planks and deck beams
2	$\frac{1}{4}$	4	7	Wedge and mold blocks
1	1	$1\frac{1}{2}$	6	Pattern for lead keel

#### WATERPROOF BIRCH PLYWOOD

1	$\frac{3}{32}$	8	30	Deck
2	$\frac{3}{32}$	$4\frac{1}{2}$	31	Bottom planks

#### DOWEL

1	$\frac{1}{2}$	30	Mainmast
1	$\frac{3}{8}$	60	Upper mast and spars

Note: All dimensions given in inches.

#### MISCELLANEOUS

20-gauge galvanized sheet iron, 8 by 10 in. for fin and rudder.  
 $1\frac{1}{4}$  lb. lead for keel.  
 $\frac{1}{8}$ -in. German-silver or brass wire, 18 in. long, for rudder control.  
 $\frac{1}{4}$ -in. copper tubing, 3 in. long, for rudder-stock tube.  
 Flathead brass screws: 1 doz.  $\frac{3}{4}$ -in. No. 3, 1 doz.  $\frac{5}{8}$ -in. No. 4, 1 doz.  $\frac{3}{4}$ -in. No. 5.  
 Roundhead brass screws: three 1-in. No. 8.  
 2 flat, brass  $\frac{3}{4}$ -in. cleats.  
 3 rigging toggles.  
 4 rigging hooks.  
 1 doz. brass screw eyes,  $\frac{1}{8}$ -in. eye.  
 $1\frac{1}{2}$  doz. brass rings for sails,  $\frac{1}{4}$  in.  
 2 brass rings for topmast,  $\frac{1}{2}$  in.  
 Brass sleeve for topmast,  $2\frac{1}{4}$  in. long,  $\frac{3}{8}$  in. inside dia.  
 1 yd. balloon cloth, 36 in. wide.  
 Seam compound.  
 Mahogany stain and varnish for hull.  
 Shellac or paint for inside of hull.  
 Round toothpicks.  
 Casein glue.  
 10 ft. fishline.  
 10 ft. mason line.  
 1 spool soft solder for rudder.  
 2 lb. plaster for keel mold.  
 Nile green enamel paint for fin and rudder.

# Smooth and Friendly Throughout the Years

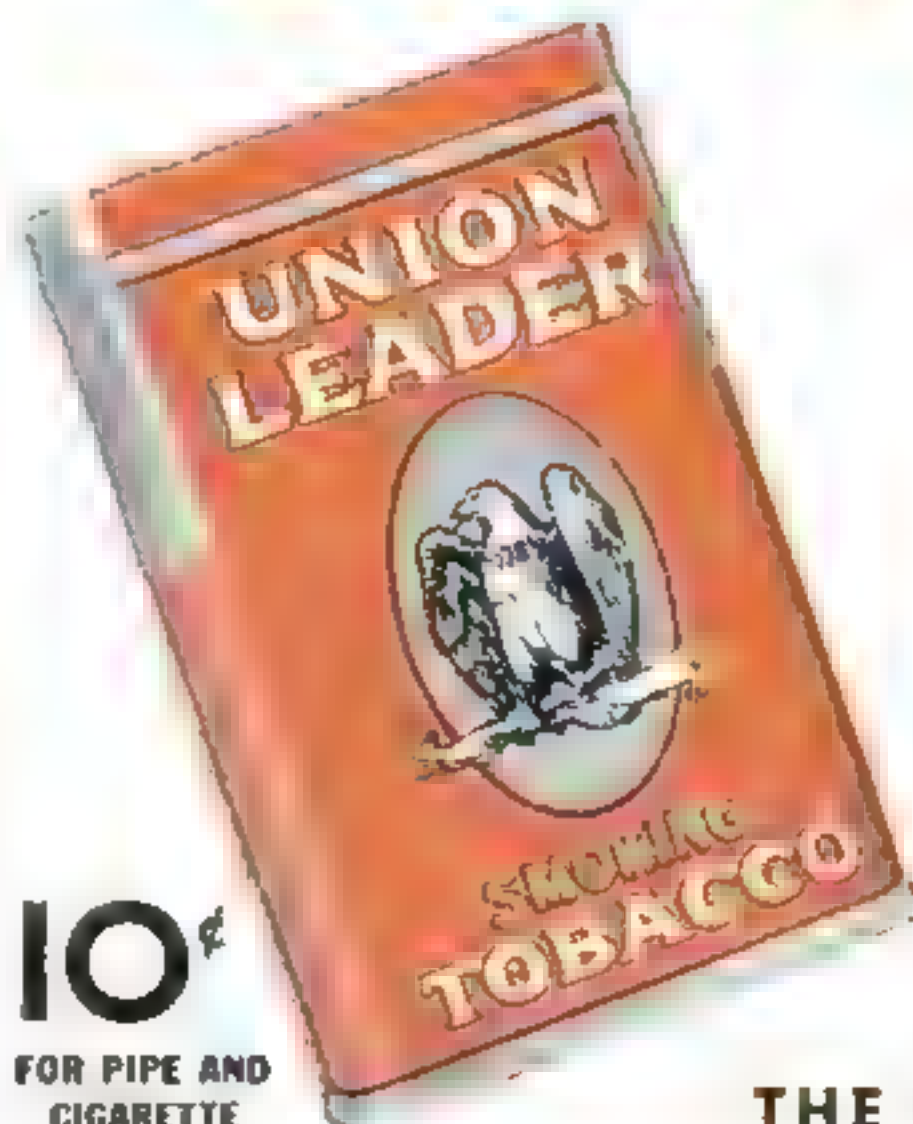
**IN 1900.** . . "I am sending you this picture of myself because it was taken at the turn of the century, when I first took up with pipe smoking. I recollect spending the next five or six years trying different smoking tobaccos—but then I happened on UNION LEADER which suited my taste just right."



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## New Boat Plans Added to Blueprint List

**B**UILDING a boat is an ideal project for spring because it is something you can enjoy all summer long and have available for many seasons to come. Pictured above are our three newest boats, plans for which are listed below. We have blueprints for many types of boats and a wide variety of other projects, so if you do not see what you want, send a stamped, self-addressed envelope for our complete list.



### BOATS

- All-Purpose Boat, 11 ft. 5 in. long, for sails, outboard motor, or rowing, 331-R..... .75
- Canoe, 16-ft. canvas-covered kayak, with sail, 192-193-194-R..... 1.00
- Combination Boat, 15-ft. hull, can be powered by sail, outboard motor, or oars, 131-132-133-R..... 1.00
- Folding Duck Boat, 13 ft. long, 170-R..... .50
- High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257-R..... .50
- Midget Boat or Pram, 9 ft. long, for oars, sail, or outboard motor, 339-R..... .50
- Racing Runabout (13 ft. long, for outboard motor), 261-262-R..... .75
- Racing Sailboat Blackcat (13 ft. 4 in. long, 5 ft. beam, weighs 250 lb., Marconi rigged), 321-322-323-R..... 1.00
- Sectional Rowboat, 9 ft. 8 in. long, can be used with small outboard motor; all wood construction, 340-341..... .50
- Sport Runabout (9 ft. 8 in. long, 43-in. beam, for small outboard motors), 309-310-R..... .75
- Utility Rowboat, 13-ft., (can also be sailed or driven by outboard motor), 224-R..... .50



### MODELS

- Aircraft Carrier Saratoga (18 in.) and a Flush-Deck Destroyer (6 1/4 in.), 226-227-R..... .75
- Alabama, famous Confederate bark-rigged steam sloop, 21 1/2-in. hull, 335-336-337..... 1.00
- Baltimore Clipper (8 in. long, carved sails), 92..... .25
- Bluenose, the famous fishing schooner, 17 1/2-in. hull, 110-111-112-R..... 1.00
- Brig Malek Adhel (20-in. hull; frame-and-plank construction), 304-305-306-R..... 1.25
- Clipper Ship Sea Witch (9 1/2-in. hull), 219..... .25
- Cruiser U.S.S. Indianapolis (12-in.), 216..... .25
- Freighter, Ocean (14-in.), 271..... .25
- H. M. S. Bounty (8 1/2-in. hull), 254..... .25
- Liner President Lincoln (14 1/4 in.), 325..... .25
- Locomotive Model, Hudson Type, HO Gauge (14 in. long; driven by 6-volt motor), 329-330-R..... .75
- Mayflower (24 in.), 83-84-85-R..... 1.00
- New Bedford Whaleboat (14-in.), 326-R..... .50
- Privatier Swallow, Baltimore clipper, (13-in. hull), 228-229-230-R..... 1.00
- Racing Yacht Seascout (42-in.), 106-107-R..... .75
- Roman Galley (19-in.), 138-139-R..... .75
- Sovereign of the Seas, clipper ship (20 1/2-in. hull), 51-52-53-R..... 1.00

- Spanish Treasure Galleon (24 in.), 46-47.... .50
- Trading Schooner (17 1/2-in. hull), 252-253... .50
- U. S. Battleship Texas (3-ft. hull), 197-198-199-200..... 1.00
- {Construction kits are available for some of these models. See page 22.}



### FURNITURE

- Bed and Armchair Table, 333A..... .25
- Cedar Chest, 17..... .25
- Double-Decker Bed, 277A..... .25
- End Table, American Empire, 241A..... .25
- Fireside Bench, Colonial, 187A-188A..... .50
- Four-Leaf Card Table, 239A..... .25
- Gate-Leg Table with Round Top, 24..... .25
- Hanging Wall Cabinet, 280A..... .25
- Modernistic Lamps (three designs), 93..... .25
- Reading Tables, Two, 68..... .25
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- Tea Wagon (turning), 13..... .25
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## Reconditioning a Dull Pencil Sharpener

STANDARD type rotary pencil-sharpener cutters become dull all too quickly under heavy usage and are usually discarded. The cutters can, however, be sharpened in five minutes by the following simple method, and the new edge lasts a considerable time.

Remove the sharpener handle and take out the cutting-mechanism cluster. Hold the handle end in the right hand, and the other end in the left hand at an angle of about 35 deg. higher than the right hand. Now bring the cutting rolls, one at a time, lightly up against a fine, high-speed grinding wheel, moving from one end of the cutter to the other. With proper light, the bright edges can be seen to disappear, and the job is done. Wash the cluster in gasoline and reassemble.—JOHN H. BECKER.

## Fitting Hammer Handle to Remain Tight

WOOD handles for hammers, sledges, or similar tools can be fitted so they will not loosen by the following simple method: Trim the end until it is from  $\frac{1}{8}$  to  $\frac{1}{4}$  in. oversize for the eye of the tool. Bevel the end and dip it into any heavy-bodied oil or cup grease as far up as the head will come. Then hold the greased end in the fire until the oil becomes foaming hot and the handle is almost at the burning point. Quickly drive the handle into the head and wedge as usual.—STANLEY RUSSELL.

## This Racing Yacht Won a Championship

(Continued from page 103)

Cut fin and rudder from 20-gauge sheet iron. Drill and countersink ten holes for screws that fasten fin to hull, and bend flaps as shown. Be careful to countersink holes correctly. Rivet lead keel to fin with brass screws. Paint fin and rudder with Nile green enamel.

Solder  $\frac{1}{8}$ -in. German-silver wire (brass wire may be substituted) to rudder and, after fastening fin to center of hull, draw wire through tube, and bend to form steering lever. Attach lower end of rudder to fin with a wire ring. The automatic steering device is shown in one of the drawings.

Use 36-in. wide balloon cloth for the sails, cutting so that the weave is at right angles to outer edge of sails and allowing for a  $\frac{1}{4}$ -in. seam. Cut main-mast from  $\frac{1}{2}$ -in. dowel, and upper mast and spars from  $\frac{3}{8}$ -in. dowel. A small metal sleeve holds the two masts together. Arrange sails and rigging as indicated; and the yacht is ready to match its prowess against any other sailing model.

For straight sailing the string from the boom is passed through the screw eye and tied to the cleat, but for sailing before the wind, the string is first passed through a small ring soldered to the tiller as shown.

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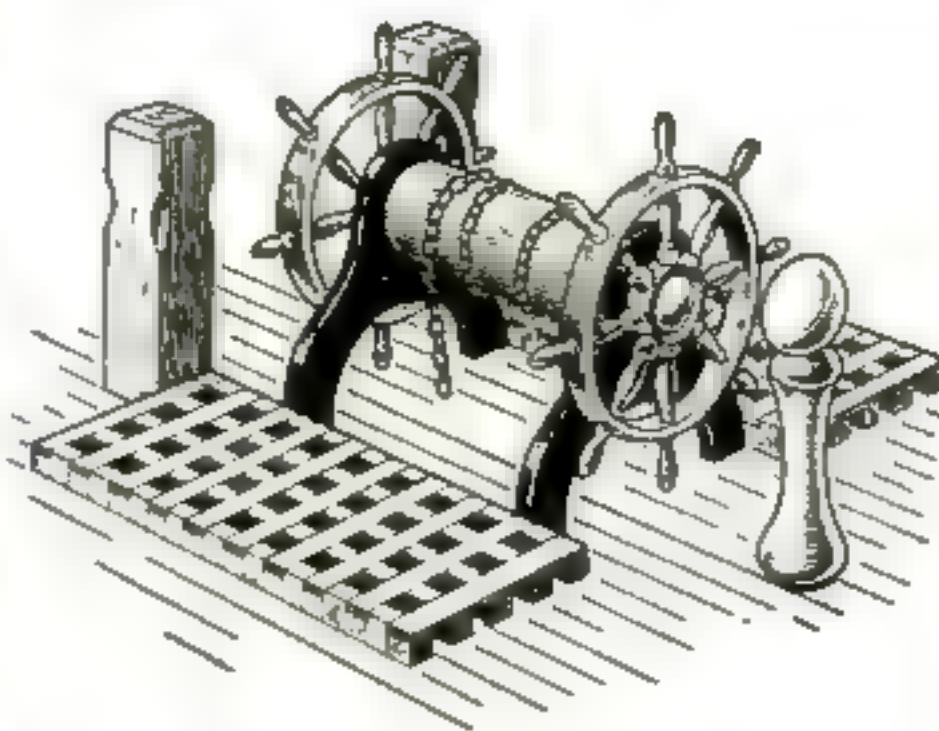
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## Guns for the 'Alabama' Model

(Continued from page 83)



on wooden stanchions of their own.

At this point I fitted the boat davits, but laid them aside until the rigging had been finished. The davits are 1½ in. high. Their lower ends are set in sockets nailed outside the hull, just above the molding; and they are retained above by cleats or brackets nailed to the main rail, which has to be cut away a bit to enable the davit to stand upright. The davits at the stern are a trifle shorter and have not much curve.

The *Alabama* had twelve gun ports, but carried only six guns in broadside. I set these in the first, third, and last ports, leaving the center ones for the pivot guns.



SKYLIGHT

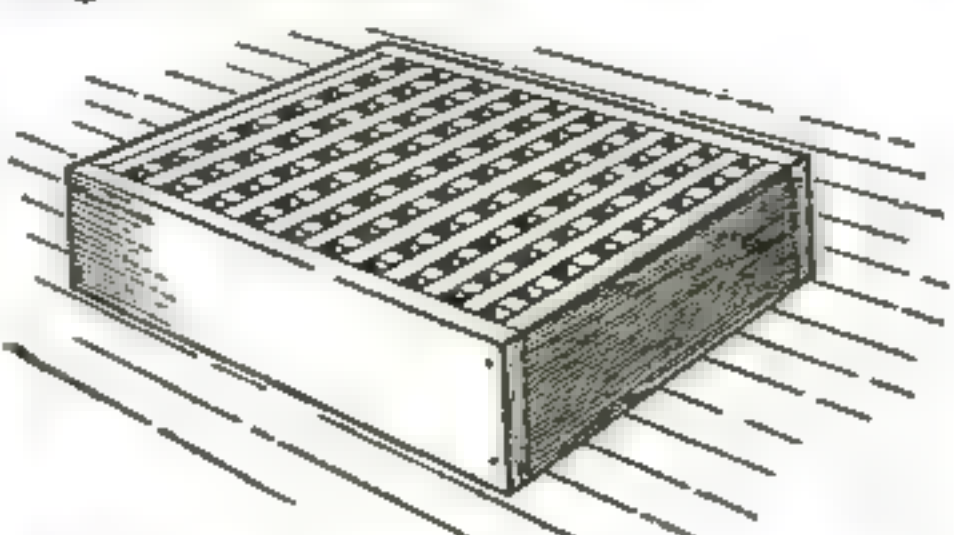
The top and side views of skylight

The broadside guns were thirty-two pounders, smooth bore. They are shown in detail. The guns themselves may be purchased or turned from brass, or turned or whittled from wood. The carriages can be built up as was done in the case of the

Hartford model, but solid ones are much easier to make.

Cut a stick ¼ by 5/16 in. in cross section, and cut the end square across. Then cut it down in steps as indicated. Hollow it lengthwise to take the gun, cut the outside to the same slope, cut notches to take one half the trunnions, and fasten the gun with bent-pin staples. For the trucks (wheels) cut a 1/16-in. round stick the right length, make a notch in it halfway down, just wide enough to take the carriage, and glue it on the bottom.

To fasten down each gun, I drove a pin point through the back of the carriage into the deck.



One of the hatches with its grating. The steering wheels are shown at top of column

The breeching is a thick cord with its center seized to the cascabel (round knob). The ends are seized to eyebolts in the bulwarks. The cord should be quite slack.

Gun tackles on each side require two 1/16-in. blocks, one fastened to an eyebolt in the side of the carriage and the other to an eyebolt in the bulwark. The end of tackle is secured by hitching it around all parts.

In addition to these, the *Alabama* had one 7-in. Blakely rifled gun and one 8-in. smoothbore pivot gun. The former was carried amidships, abaft the foremast, and the other abaft the mainmast. I simplified the pivot carriages for these by making carriages



A portion of the poop-deck railing, which is supported on turned wooden stanchions

as previously described. Each was set on a piece of 1/16-in. plywood painted to represent the sidepieces and athwart battens. Small trucks were placed beneath, as illustrated. The plywood was secured to the deck with pins.

Tackles with two blocks each were taken from the back of the slides to eyebolts in the deck, and others from each side of the gun carriages to similar eyebolts.

The guns and carriages are all black.  
(TO BE CONTINUED)

## Trees In Miniature

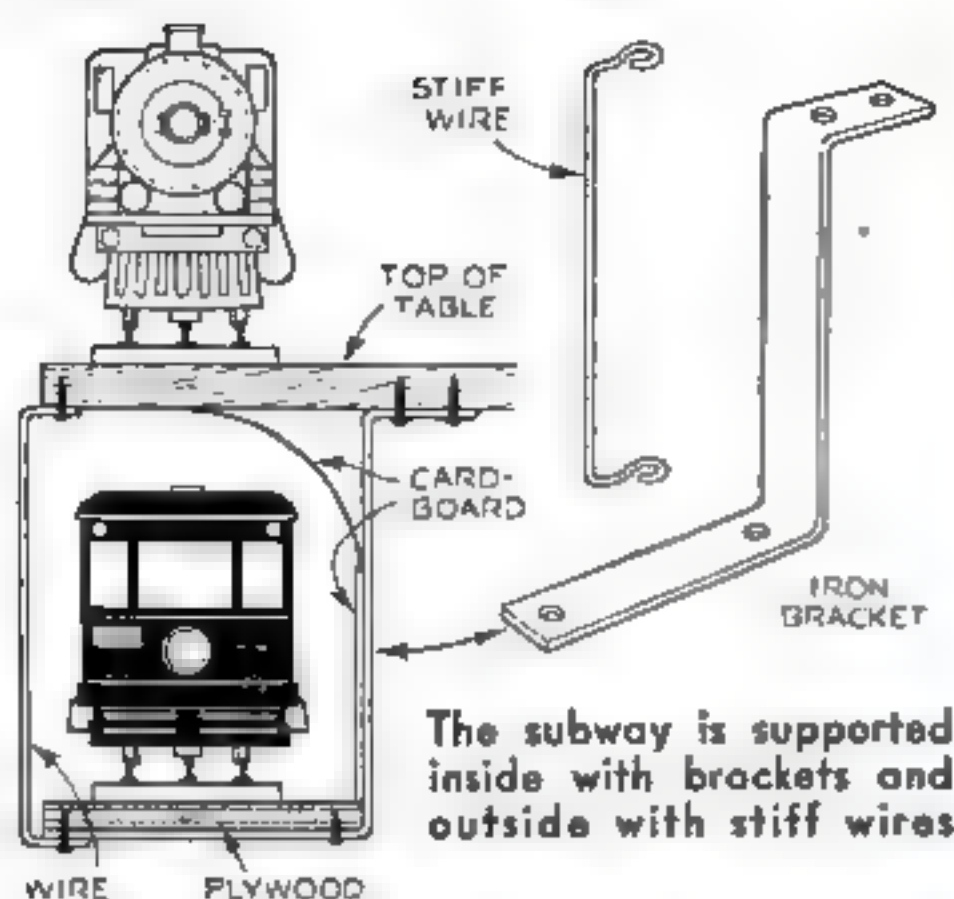
MINIATURE trees can easily be made from ordinary rubber sponges. Cut them to the desired size and shape; then, using tweezers, tear out little pieces to give depth between the branches. Stick the sponges on sticks with silicate of soda (water glass).

Now fill a tin can with water to within ½ in. of the top, the can being deep enough to enable the tree to be completely immersed. On top of the water float several colors of lacquer in suitable shades such as greens, blues, and yellows. Dip the miniature tree down through the floating colors, and hang it up to dry.—C. A. VOELCKEL.

## Making Screen Doors Fit

SCREEN doors that do not fit tightly at the top or must close against an uneven frame may be improved by nailing a strip of old inner tube, folded double, along the top of the door. The slight bias pull (from cutting a straight strip from the curved tube) makes it fit well, and it adjusts itself to uneven surfaces.—H. PAPASHVILY.





## Adding a Subway Line to a Model Railway

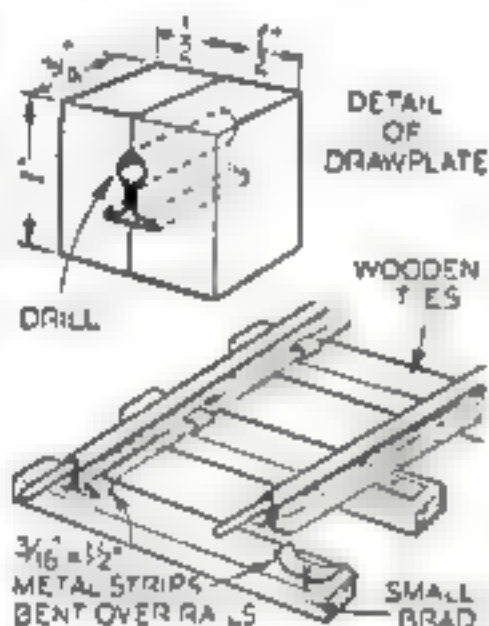
IF YOU have a permanent model railway layout on a table or shelf and want to try something new, why not add a subway line by the method suggested in the sketch above? It costs little except for the track and provides many hours of enjoyable work in planning and building the stations, signal system, and the like.

The plywood roadbed is supported by brackets on the inside and stiff wires on the outside, bent as shown and spaced a foot or two apart. Strong cardboard is used for the wall, and thin white cardboard for the ceiling.

A double-track line may, of course, be built in the same way, but in this case it is advisable to dispense with the curved ceiling.—JORGE ALBERTO OLEAGA.

## How to Straighten Old Tin-Plate Track

NICKED and slightly bent model railway track of the common tin-plate type may be straightened by making a sort of drawplate from two pieces of 1 by 1/2 by 3/4-in. mild steel. Put the 3/4 by 1-in. faces together, clamp in the vise, and drill a hole 1/4 in. from one end on the crack, just large enough for the circular top part of the rail. Cut slots for the lower, flanged part, and file the center.



Drawplate and method of fastening the track

Now clamp the pieces with the cut-out part above the vise. Insert the end of the rail with the pin into the opening, where it should be a tight fit. Hold a block of wood over the other end and lightly tap the rail through. When the end protrudes, grip the rail around the pin with small pliers and pull it straight through.

To fasten track of this kind to wooden ties, cut a number of pieces of thin metal 1/2 by 3/16 in., punch a hole in the center, and nail them to the ties with one cigar-box nail each. Bend the ends as shown.—EDWIN L. EDLER.

"You takes a lil tech o'dis,  
an' a lil dab o'dat..."



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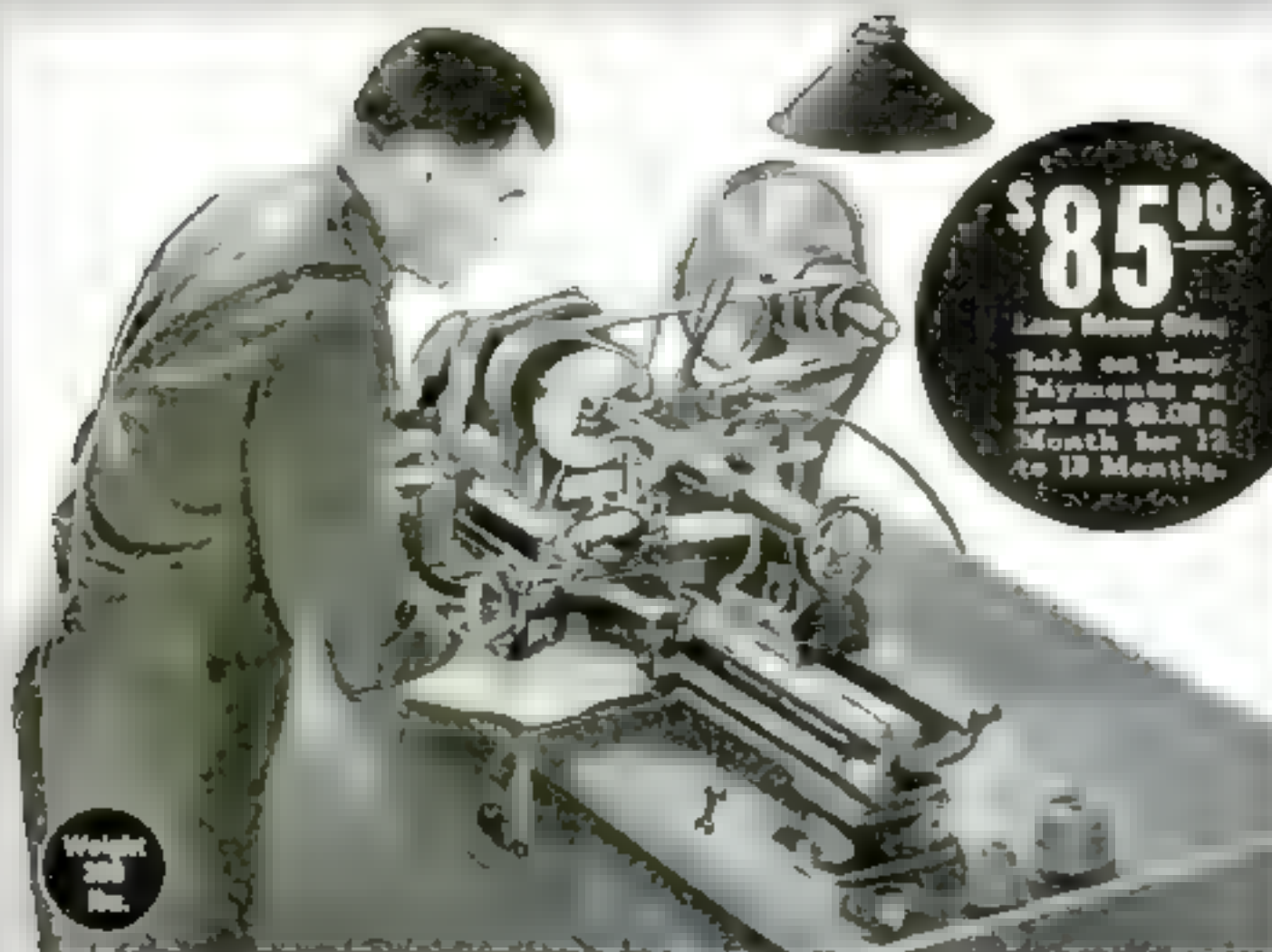
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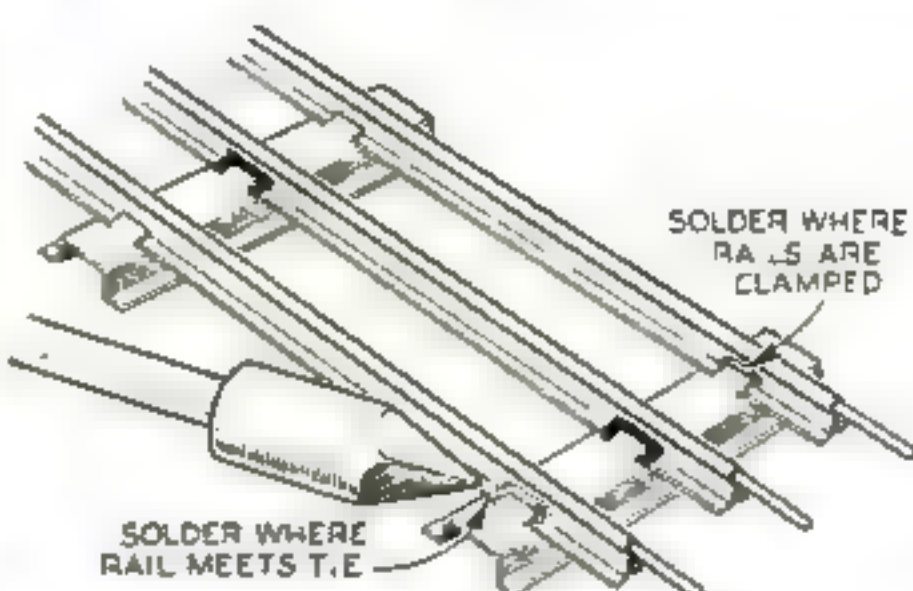
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Two ways to make the track more rigid

**TIN-PLATE** model railway track can be improved by soldering the underside of each rail near the ends. The rails then will not spread apart, but will provide a tight fit for the connecting pins. Drops of solder placed where the rails are clamped to the ties also will help the rigidity.—SAMUEL COSMAN.



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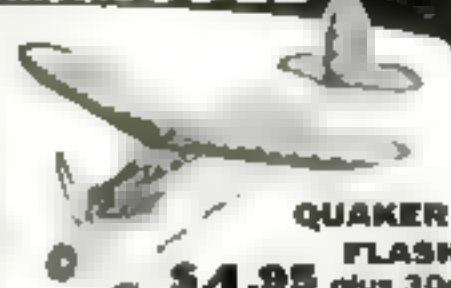
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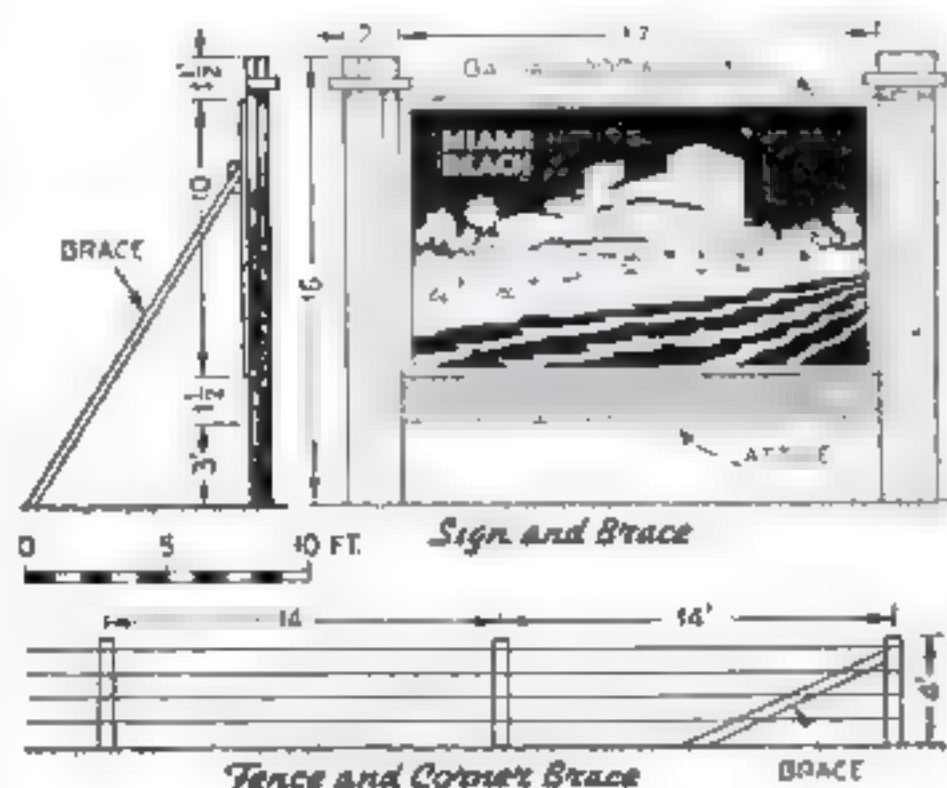
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## Miniature Signboards for Model Railway



**C**OLORED magazine advertisements, when cut out and pasted on cardboard, make good miniature signs for a model railway. To keep the signs from curling, paste a second piece of paper on the back.

Balsa strips were used for the framing and for the supports at the back of the signboard illustrated. The drawing is purposely dimensioned like a full-size signboard so that a model may be made to any scale desired. The lattice at the bottom may be omitted or imitated by using cross-stitch canvas, a coarse, stiff cloth intended for art needlework, with every third thread pulled out. The lattice is painted to match the rest of the framing.

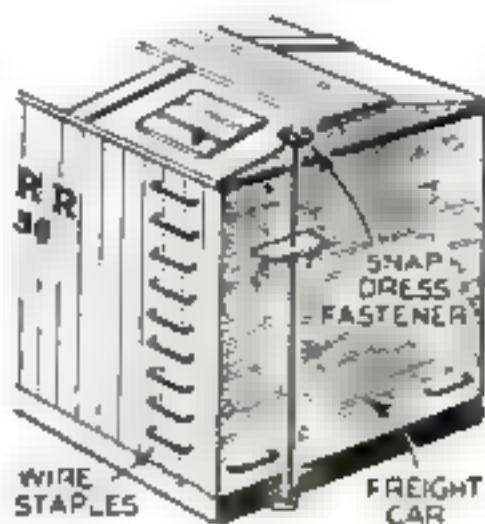
Grass for a surrounding pasture is made by painting the base with light green paint, mottled here and there with pale yellow. Before the paint is dry, sprinkle a thin layer of fine sawdust, previously dyed a grass green, over the "ground."

Nearby trees are small pieces of dyed sponge glued to small twigs. The sawdust and sponges are easily dyed if placed in a cloth bag and dipped in dye.

If your road is built to a scale of  $\frac{1}{4}$  in. to the foot, ordinary kitchen matches will do for pasture fence posts. Place them in holes drilled in the base and then clip them off so that they will be about 1 in. high. The barbed wire is fine black thread glued to the posts. The corner posts are braced as shown in the sketch.—J. W. CLEMENT.

## Freight-Car Details

MODEL railroaders who build their own box cars will find that black snap dress fasteners make surprisingly realistic brake wheels. Wire staples of the type used in offices for fastening papers together can be used as rungs for the type of ladder in which the rungs are fastened separately to the side of the car. The staples come in several widths so it is possible to find a size for both "O" and standard gauges.—W. J. BAKER.



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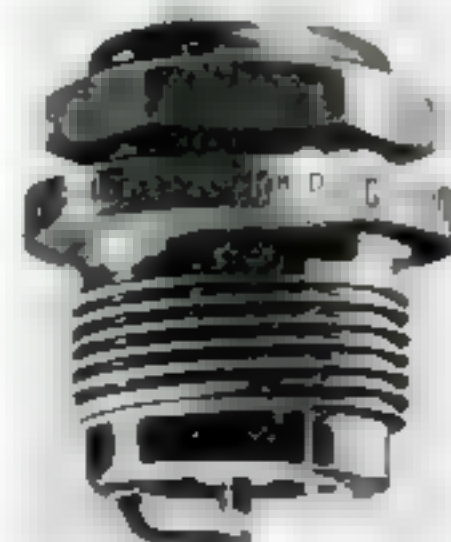
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**UniveX**

## Photographing Children

(Continued from page 96)

thin, cheap silk (or tracing cloth), and is large enough to cover the front of the reflector.

The equipment should be all ready before the child or children are called in. If the background (wall paper or paint) is not of a comparatively soft shade and design in the room you are to use, then a plain white or light-colored sheet should be suspended over the wall for a background. You will find, as you progress, that a white background can be rendered photographically as any shade you wish, from white to very dark. This is governed by the light which falls upon it. The farther the lights and subject are away from it, the darker it will become.

For a start the model position should be about three or four feet from the background; the lights at least that far away again.

THE camera position will be governed by the amount you include in the picture and the angle, but for normal results should be at the eye level of the model. The camera should always be on a firm support or tripod.

Lay near the camera a few "props" in the nature of books or toys, but avoid having too many objects appear in the picture. Simplicity is one of the major attractions in a portrait.

Now bring in the child (or children). Play with the child, show him where you want him to stand or sit, but make no attempt to pose him. Get the child to forget the camera and become so absorbed in your conversation that he even forgets himself. A gentle reminder as to position may be introduced from time to time, but do not make the desired position of paramount importance.

Formal portraits with full attention apparently directed toward the camera are very little more difficult. You simply replace the interest-creating object with a story or with absorbing conversation. The little boy in the portrait was listening intently to a deeply interesting (to him) conversation on the habits of gophers.

The primary thing, of greatest importance to remember, is that portrait lighting should be simple. The light should come fundamentally from but one source. Although we shall assume you are going to use two lights, the first is placed relatively close so as to light the subject, but the second light is at a greater distance to light up the shadows cast by the former. These shadows should still be shadows, yet illuminated well enough to show a degree of "tone" on the finished print. The amount of light to throw into the shadows is determined largely by experience.

If the light is coming from two equal sources, each illuminating a side of the model's face, and if the secondary source is twice as far from the model as the first, then the light falling on the model's face from the secondary light is not one half as intense as that from

(Continued on page 111)

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Grooves inside barrel make the Crosman a real rifle with all the hair-splitting accuracy this term implies. Shoots bullet (pellet) same diameter as .22 powder rifle, but silently, powerfully, with no recoil, using the terrific force of compressed air—same force U. S. Navy uses to drive 2000 lb. torpedoes. Marvelous for target, small game. Single and 20 shot repeater models. No license required. New "clickless" Fore-arm and Target Stock.

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## A Simple Way to Check Camera Sunshades

**D**O YOU ever find your prints shading off toward the corners? One of the commonest reasons is that a homemade sunshade is too long or too narrow, and is thus cutting off some of the light that should be coming through the lens. Strangely enough, the view on the ground glass often will not clearly indicate this fault. If you are in doubt, a simple way to check your sunshade is to remove the ground glass, set the bellows at infinity, open the lens wide, and look through the lens from each corner of the ground glass opening. Hold the camera vertical, look directly forward, and keep your eye close to the normal plane of the ground glass. If you can then see the edge of the sunshade through the lens, you can be sure that it cuts off some of the light to your film, and it should therefore be shortened or widened.—K. M. S.

## Photographing Children

*(Continued from page 110)*

the first, but has only one quarter the intensity. This fact should be relied upon in determining the range of contrast you wish from highlight to shadow. (Negative development also controls contrast but will be overlooked, since only lighting is being discussed.)

The placing of the lights should be somewhat as follows: The dominant light, for normal effects, should preferably come from above. The well-established 45-deg. lighting is suitable for the beginner. This calls for the first and nearer light to be about 45 deg. to one side and 45 deg. above the model's head and, of course, in front of model. The second light is placed, for a start, about twice as far from the model as the dominant light, and about camera level. It is on the side of the camera (and model) opposite the dominant light. This second light is now in a good position, being lower than the first, to throw some light into the shadows cast on the face by the various features.

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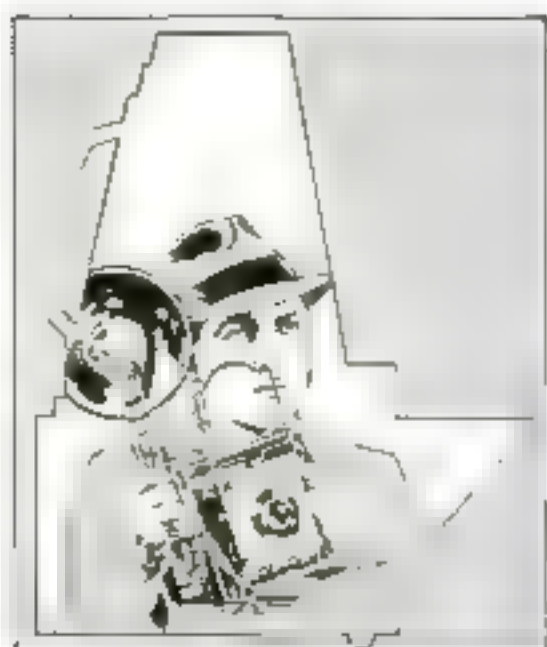
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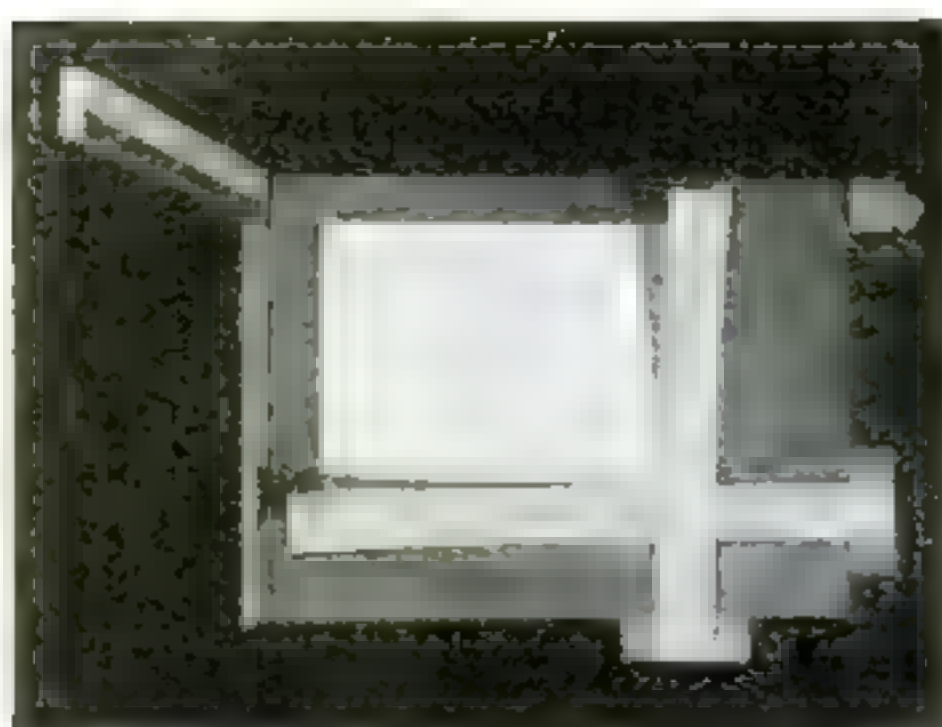
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Easel with paper in place ready for the hinged L-shaped frame to be fastened down

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A FLAT door panel 14 by 18 in. was used as the base of this enlarging easel. At one edge is hinged an L-frame made of four pieces of wood, which are nailed together so that the top board of one side laps over the bottom board of the other side at the corner. The joint is glued and nailed or screwed to keep the legs at true right angles. The inside edges are lined with brass strips 1/32 in. thick and are ruled in inches. A small wooden clamp keeps the frame closed while enlargements are being made.



Each brass strip is mounted on a slide

The easel is adjusted to take any size of enlargement by means of 1/32-in. brass strips 1 1/4 in. wide. These are fastened to wooden slides. The metal strips are curved so that pressure is exerted on the paper when the ends are clamped under the frame. The edges of the strips must be absolutely straight.

In order to tell how far the paper is being placed under the frame so that various sizes of margins can be made, that portion of the easel under the frame is ruled with long lines 1/4 or 1/2 in. apart.—F. M.



Closing the frame holds the paper securely

## Waxing Ferrotypes Plates

FERROTYPE plates can be waxed by rubbing them with a crumpled sheet of thin waxed paper such as is used for wrapping sandwiches. The plates are then polished with a soft cloth.—H. L.

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Complete kit, with wiring instructions \$5.98. Completely wired ready for installation \$8.95. Operates on 110 V. AC-DC (Not a toy but proven equipment). Used for light controls, alarms, signals, door openers, and many other electronic applications. Terms 1/3 cash with order, balance C.O.D. Consult us on your electronic needs. We build to your specifications.

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## Chisel-Grinding Guide from Two Tool Rests

A GRINDING wheel mounted in a wood turning lathe and two lathe tool rests have been used by the writer for some time in putting true, even bevels on carpenter's chisels, turning gouges and skew chisels, plane bits, and other cutting tools. Being adjustable, the tool rests allow any angle to be set. —R. W.



This ingenious combination of two tool rests forms an adjustable grinding guide for tools

## Attic Ventilating Fan

(Continued from page 73)

It is recommended that ball-bearing thrust washers be placed between the fan hub and the motor frame to take the fan-blade end thrust. Such a bearing may be purchased from home-workshop supply houses or some gear manufacturers for less than fifty cents.

The motor mounting will depend somewhat on the builder's own plans. The support shown was made from a piece of 1-in. pipe fitted inside a piece of 1½-in. pipe. A pipe flange was screwed to the bottom of the 1½-in. pipe, and another pipe flange on the top of the 1-in. pipe. The motor was attached to a wooden base by rubber mountings. The height of the complete unit is adjustable and can be maintained by set screws in the 1½-in. pipe section.

The fan should be installed in a window or suitable opening in the attic. If possible, select a window on the side of the house away from the prevailing winds and where there will be no serious interference with the draft from the attic passageway to the rest of the house. Locate the unit so that it will not prevent the raising or lowering of the window in case of a severe storm.

The best plan is to construct a wooden frame to cover the window frame, with a hole to clear the diameter of the fan blade. The one illustrated was made of ¼-in. plywood. It is set out with spacers so the window can be closed easily.



## ADrift WITH DYNAMITE on STORM-TOSSED BARGE!

MACKENZIE ON RAMPAGE, SENDS LONE BARGEMAN TOWARD ARCTIC ICE

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"One night, with the barge loaded with freight including hundreds of cases of dynamite, a terrific storm blew up, my anchor dragged. Bobbing like a cork the great barge was swept down toward the broad Mackenzie. It pitched against the bank with a force that threw me off my feet, and started on again.



"Once in the Mackenzie I'd be Arctic-bound! Somehow I must get a line on shore. It seemed impossible, but I yelled at the top of my lungs... I heard dogs barking. Then as I flashed my light on the shore, a trapper who was camping near by came running down to the water's edge.

"I heaved the line for all I was worth... the trapper got it! Then I focussed the light on a big tree while he made it fast. Later, we had a good laugh over it... but right then I fully realized that but for the trapper's help and my fresh DATED 'Eveready' batteries I would have been drowned or blown to bits when my barge drove on the rocks downstream!

(SIGNED)

*T. H. Inkster*

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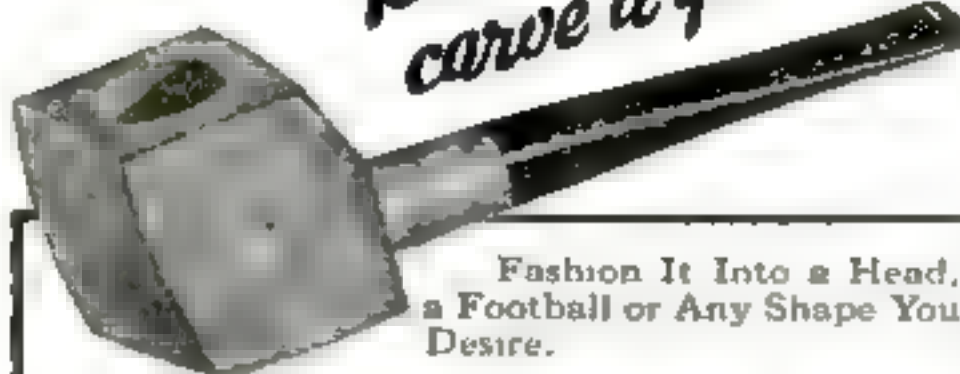
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In handy tubes, 10c, 15c and 25c. At hardware and sporting goods stores. If your dealer can't supply you, send 10c and we will mail a tube postpaid. Address Department O.S.

**THE YALE & TOWNE MFG. CO.**  
STAMFORD CONN.

## Police Cameras Reveal Crime Clews

(Continued from page 51)

used on previous films, has been made available to photographers. With such films and the fast lenses now available, a detective can take pictures which are fully exposed, and yet stop all action even on dark or rainy days or in comparatively dim interiors. It adds greatly to his chances of getting his man—on film.

THE latest color films are also playing a part in convicting the guilty. Not long ago, a jury was sitting on a case in which a child had been beaten atrociously. Conviction was quick after colored movies were admitted to the evidence. They revealed the discolored flesh where the little girl had been struck again and again.

But the camera is as quick to free the innocent as it is to convict the guilty. Take one striking instance reported from a western state.

A woman was on trial for the murder of her husband. Her story was that he came home drunk and threatened her with a revolver. During the struggle on the front lawn, she swore, the gun went off accidentally and he was killed. The district attorney, however, maintained that she shot him as he came up the walk, firing from inside the house through a screen door. The whole case hinged on proving or disproving this latter statement.

The trial reached its climax when defense attorneys handed the jury a sheaf of photographs. Each was the picture of a bullet. All except one had criss-crossing marks in the lead. Time after time, the bullets had been fired through screens into oak boards. In spite of the fact that the wood is far harder than a human body, the recovered bullets always retained the imprint of the wire mesh. Yet, the photograph of the fatal bullet showed no such markings. The camera, more clearly than hours of talking, proved that the lead which killed the victim could not have been fired through the screen door. The case for the prosecution collapsed; the woman was given her freedom.

THE whole science of forensic ballistics, or tracing bullets to the guns that fired them, is based on taking pictures through comparison microscopes. In many other ways, the camera records in permanent form the findings of the different sciences applied to criminology. It records fingerprints, scars and wounds, the position of footprints, teeth marks, forgeries, mutilated documents, and other pieces of evidence which aid in the solution of crimes.

Recently, newsreels have helped identify rioters, and fast cameras have snapped "repeaters" at the polls. One of the latest applications of photography to police work is the assembling of large albums of pictures, showing hundreds of known pickpockets, footpads, and

other underworld characters who follow fairs and conventions. By familiarizing themselves with the faces of these undesirables, the local police in a city where an exposition or convention is to be held can increase their chances of nabbing criminals before they can get into action.

Trapping insurance racketeers is another phase of the camera work of modern detectives. One example will illustrate the methods used.

IN Maryland, a mason took out a large accident-insurance policy. Only a few weeks later, he reported he had had a bad fall and had injured his right arm so severely he was no longer able to work. Company physicians examined him. Beyond a few minor bruises, they could find nothing wrong. However, the laborer insisted he could bend his elbow only with extreme pain and demanded the payments called for in the policy.

This was the situation when a camera detective, employed by the company, reached the town in which the mason lived. For days, he shadowed the quarry with his miniature outfit slung in its ever-ready case. Always, in public, the laborer's arm remained as stiff as a steel shaft. Early one Sunday morning, however, the injured man appeared in his back yard with a heavy hammer and began pounding down a row of bean poles, unaware that a hidden camera was recording him at work, bending his right elbow without effort at each lift of the hammer. That one set of pictures nipped his attempted fraud in the bud and saved the insurance company hundreds of dollars.

Telephoto lenses, which permit the recording of such pictures from a distance, have been used effectively in several cases. They give close-up views while permitting the photographer to snap the pictures from a distant hide-out.

EVEN aerial cameras, pointing down from the sky, are being enlisted in the scientific war on crime. Some months ago, a silver-winged plane zigzagged back and forth across Long Island Sound while the aerial camera it carried snapped picture after picture. It was recording "submarine" shots in search of a vital clew in a kidnap case. The resulting negatives recorded objects lying many feet below the surface of the water. Although this sky hunt failed to reveal the body of the victim, the unusual procedure opens up new possibilities for rapid searches of the kind. Photographs taken from an altitude often reveal valuable clews not evident to the ground observer.

Occasionally, luck as well as foresight plays a part in solving crimes by photography. When a policeman was making his rounds in the park

(Continued on page 115)





## A LAKE IS MADE FOR LOVE

• **PADDLE** the peaceful paths of beauty—with rippled reflections and dreams. Spend peaceful days on the waterways. Glide through the glories of Nature.

An Old Town Canoe is easy to paddle. Quick to respond to the blade. True Indian lines—made steady and strong. Built for long years of hard use.

**FREE CATALOG** shows all kinds of Canoes for paddling, sailing or outboards. Also Outboard Boats, including big all-wood family boats, Rowboats, Dinghies. Write today. Address Old Town Canoe Company, 415 Main Street, Old Town, Maine.

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Light weight, durable, carefully built boats at remarkably low prices. Made of toughest galvanized copper bearing steel. Wood gun-wales. Heavy transoms for outboard motors. Two or more built-in air chambers for extra buoyancy in case of upset. Real wave riders; easy to handle. Never leak or warp. Always ready for use. Both round and flat bottom boats; all sizes and styles.

Write For Free Boat Booklet with description and prices of complete line of metal boats—knockabouts for fishermen, light weight lively boats for parks and resorts, heavy duty craft for outboard motors. Dealers Wanted—who can develop volume sales.

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**New, Larger Sudbury SOIL TEST KIT \$2.00**

Complete with instructions and data on plant needs

Use this kit and be your own soil chemist. New larger model gives 20 individual tests for nitrogen, phosphorus, potash and acidity, giving all essential information for successful lawn or garden. If not sold by your dealer, send \$2 direct to manufacturer.

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**POWERAY**  
New 6-volt electric lantern.  
80-100 hours light. 700 ft. beam. 4 1/2 inch reflector.

**Buy ONE OF THESE "BIG LITE" DELTAS**

**POWERLITE**  
6-volt Deluge electric lantern. 400 ft. beam. 80-100 hours light. Two reflectors. At sport and hardware dealers.

**DELTA ELECTRIC CO.,**  
Dept. 400

## Police Cameras Reveal Hidden Crime Clews

(Continued from page 114)

of a large eastern city, not long ago, he discovered a girl slumped on a bench, one arm hanging limply, a revolver resting on the ground below the lifeless hand. It had all the appearances of a routine case of suicide.

And so it remained until the police photographer developed the negatives of pictures he had taken at the spot. In the slanting rays of the early morning sun, a faint covering of dew stood out clearly on the bench. And, on the seat next to the girl, there were revealed sharp outlines in the dew that proved beyond doubt that some one had been sitting there shortly before the policeman had arrived. Detectives abandoned their suicide theory and turned to a check-up of the girl's acquaintances. As a result of this hunt, the murderer was identified, captured, and brought to trial.

IN Rio de Janeiro, an Englishman was accused of the murder of a Brazilian acquaintance with whom he had quarreled violently a few days before. On the day of the victim's death, their differences apparently had been patched up and the two went sailing together in a small boat in the harbor of the city. When the boat returned to its mooring, the Brazilian was dead. He had been killed, the Englishman said, by a fall from the masthead to the deck.

Police, however, noted that a heavy oar was missing from the boat's regular equipment. Medical experts testified that death resulted from a blow on the head which could easily have been administered by the oar. Details of the quarrel were aired in court and the case looked hopeless for the Englishman until defense attorneys introduced one of the most remarkable pieces of evidence ever produced in court. It was an enlargement from a casual snapshot made by a tourist.

On the day of the Brazilian's death, a cruise ship had steamed into the harbor at Rio. One of the passengers, impressed by the view, snapped the picture with his camera. When the film was developed and enlarged, it contained positive evidence that the Englishman's story was true and insured his acquittal. For the film revealed a dark blotch on the sail of a boat which, by sheer chance, had been within the camera's range. The enlargement proved that the dark spot was the body of a man falling from the masthead past the white sail to the deck!

THUS, by chance and by design, the camera is playing a vital part in furthering justice. It is a powerful new weapon in the hands of the police, a weapon which is being used for new tasks from month to month, a weapon the underworld does not know how to fight. Every criminal who hides his face from the piercing eye of a camera, pays tribute to its worth as a potent aid on the side of law and order.



## SHARP CLAWS

*for sure grip*

The Plumb meets the supreme test of a nail hammer. Sharp beveled claws nip into nails, grip tight, pull heads through wood!

Claws with slight roll across back, catch closely driven nails. Crowned face protects work from nicks, dents.

Handle has slim neck, absorbs shock! Comfortable grip with flared end to prevent slipping.

Head and handle in perfect balance. Feel how the Plumb rises, falls, with natural swing of your arm! See Plumb's Patented Take-Up Wedge. Keeps head tight on handle merely by a turn of your screwdriver. Better work of all kinds with the Plumb.

Ask your hardware dealer for a Plumb! With the Red Handle and Black Head.



FAYETTE R. PLUMB, INC., PHILA., U. S. A.



# Riches from the Wind

(Continued from page 55)



Rust and scale have accumulated in your radiator all winter. They are choking the delicate veins that circulate water and keep your motor cool. An overheated motor is a lazy motor. And overheating may cause costly damage. Clean out your radiator. It costs only 10c. (25c for the largest trucks and tractors.)

You can do it yourself in a few minutes. Pour a little SANI-FLUSH in the cooling system. Run the engine. (Follow directions on the can.) Then drain, flush and refill with clean water. Do this regularly, twice a year. Keep the radiator clean and clear. Motors run cooler. Save power. Save repairs. SANI-FLUSH can't harm motor or fittings. You'll find SANI-FLUSH in most bathrooms for cleaning toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores. 25c and 10c sizes. The Hygienic Products Company, Canton, Ohio.

**Sani-Flush** **Safe**  
KEEPS RADIATORS CLEAN **NOT CAUSTIC**

**New Plastic Elastic!** **MENDS 100 THINGS**  
**SAVES 100c**

**FREE BOOKLET**

**FLEX-O-FIX**—Contains Water—EASY TO USE. Just apply from tube—dries tough and elastic. **MENDS:** rubber, leather cloth, etc. **MAKES:** mounds, washers, pack on, etc. **INSULATES:** electric wires, no tape required. 10c, 25c, 50c tubes. **WRITE NOW** for **FREE BOOKLET** showing hundreds of every day uses. **Buy a tube Today!** Ask for **FLEX-O-FIX** at auto supply, hardware, sporting goods, variety stores. If not available locally send money and dealer's name to—**Frund Products Co., Dept. P58-43 E. Ohio, Chicago**

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Set Up makes any electric razor shave close & clean. Rub on beard, let dry, then shave.

**1 MONEY BACK GUARANTEE**

**PINAUD**  
PARIS  
**SET-UP**

To a hard-headed business man, this stage would have marked the time to cash in. But the brothers reasoned that if their propeller design was good enough to run a six-volt generator for charging radio and automobile batteries, it could be made to work equally well on a thirty-two-volt charger for light and power on the entire farm. So, in the course of time, they had a twelve-foot propeller which, by their road test, was the best they had so far whittled out.

**T**O GIVE it a real trial, they needed a tower high enough to get the propeller above houses and trees. They talked their father into buying a supply of strip steel and several hundred feet of wire rope. They even persuaded him to help them drill hundreds of holes in the strips and bolt them together. When the job was done, they had a tower of novel design, extraordinarily sturdy and economical. They sell towers like it today at only forty cents for each foot of height.

Mounted high above the farm, this pioneer generator plant supplied ample current for every purpose of light and power. It is still there, still doing its job, unchanged since first it was erected. It has cost nothing for upkeep—or for anything else—beyond a few drops of oil occasionally for the generator and a yearly coat of paint for the propeller.

For the average farm, the thirty-two-volt set gives all the light that is needed, runs separators and other farm machinery, operates shop tools of moderate size such as grinders, and all the ordinary household equipment—washer, vacuum cleaner, radio, sewing machine, and electric irons. It is not intended for use with electric ranges or refrigerators, or for running silo-filling machines or anything else requiring motors above one horsepower.

Each development called for a new invention. The high-speed propeller, for instance, was fine—except that in a high wind it might dash itself to pieces. The boys had to settle down and develop an airfoil spoiler, which in plain language is a form of brake—but without friction—to keep the blade from running too fast in a high wind.

**I**T WAS clear to the brothers that they needed a lot of cash to carry out their plans. To produce it they spent their last cent to build an ice boat powered with an automobile engine to drive an airplane propeller. They finally sold it for less than it cost them, and meanwhile lost a lot of precious time. What could they do next to provide cash?

The five-foot propeller they had erected on the storm-racked tower several years before was still giving good service in charging radio, car, truck, and tractor batteries. Such propellers should be salable. They inserted in the

(Continued on page 117)

classified sections of Iowa farm papers a four-line advertisement which read, "Let the wind keep your radio and auto batteries charged on electricity made with old auto generator and our propeller. \$3.50. Wincharger, Cherokee, Iowa."

On the first day, the rural mail carrier brought one order with a remittance for three dollars and a half. Next day he brought several more. Soon he was averaging six a day, then eight, then ten. The brothers were whittling like mad, and hired a neighbor boy to help them.

**W**HAT the customer received for his money was simply a propeller, with a set of printed instructions telling how to hook it up to whatever old automobile generator the customer might have, and how to mount the unit on a pole, roof, or tower.

More money was coming in to the Albers farm in every day's mail than had previously been seen in an average month. The boys had accumulated better than a thousand dollars in the bank. Their advertisements appeared in farm papers throughout the Middle West. They were often two weeks behind in their shipments. Then they decided to quit the business until they could develop a machine to turn out propellers.

Nobody knew how to help them. They hunted up experts on woodworking and learned that every attempt to develop a machine for shaping airplane propellers of wood, beyond a preliminary roughing-out, had been a failure.

Undaunted, however, they went ahead with their work. They made cutters of stray bits of steel salvaged from junk heaps, and tied their machine together with carriage bolts. They hitched it by a belt to the tractor outside their workshop window, and fed in a piece of wood. The thing practically blew up.

**T**HEY drove over to Sioux City to ask the superintendent of the sash-and-door mill what they had done wrong. After a little discussion they found they had omitted a chip breaker, which is absolutely necessary in a wood mill. They went home, bolted their machine together again, and put in a homemade chip breaker. It worked! They had developed a machine which all the woodworking experts had told them was both practically and theoretically impossible. It was essentially the same as the machines which today, fashioned of alloy steels from details worked out by machine-tool designers, are turning out the hundreds of propellers which the brothers sell every day.

Their propeller goes through the machine only once, the device making a finished cut in one operation. After this it requires only sanding before painting. To the best knowledge of the brothers and their patent attorneys, there is no





## Making Money With Your CAMERA

Here is a brand-NEW, exceptionally practical manual which will teach you many kinks and tricks, ways and means to take and sell pictures. Written entirely for the amateur or semi-professional camera hobbyist, it clearly demonstrates by pictures and directions the principles of picture taking that bring you photos which are marketable—and how and where to sell them.

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### THE TWENTY FIVE SECTIONS

of the manual cover such subjects as: Photography Isn't Difficult; Salable Pictures of People; Dollars From Architectural Photography; Pictures For Publication; Pictures For Rotogravure Sections; Ventures In News Photography; Syndicating Photographs; Pictures For The Magazines; Landscape Dollars; Selling Photographs To Manufacturers; Developing and Printing For Others; Miniature Camera Possibilities; Lantern Slides and Their Relatives; Salvaging Old Photographs; Still-Life Photography; Photographic Novelties; Accidental Profits; Nature Photography; Movie Profits; Coloring, Retouching, etc.; Invisible Light Magic; What About Stereo Photography?; Useful Accessories You Can Make; Miscellaneous Information.

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Orders from outside U. S. must be accompanied by \$2.00

## Riches from the Wind

(Continued from page 116)

other successful machine for making wooden propellers.

Three times, in pushing their way to a successful solution of their privately discovered problems, Gerhard and John Albers went completely and thoroughly broke. They had started with only a few dollars apiece. They used these up in their earliest experiments with the airfoil propellers. Next they reached, through pursuing their iceboat will-o'-the-wisp, a state which in anyone of greater financial prominence would have brought on bankruptcy. Finally, after making more money than they had ever before seen and saving it faithfully, they gambled the entire sum and the limit of their credit in building the machine for shaping propellers.

WHEN they emerged, flat broke and triumphant, they really had what they had begun groping for in undefined fashion six years before. Now they had proved there was a demand for their propellers and had a machine which could meet any conceivable demand. It was time to harness these together into a source of income.

They found in Sioux City, the nearest big town, some one who could provide financial backing and selling experience. They rented a factory, put their advertisements in the paper, and began turning out their chargers several times as rapidly as ever they had done in the whittling days on the farm. They induced a leading maker of automobile generators to manufacture a generator especially designed for their outfit, and they bought it in carload lots. They sold the entire rig—propeller, generator, tower, and all—wherever they could find a good market. But they did it so far off in the back lanes of trade that anyone who did not read the farm papers or live in a little town far away from the main highway was unlikely ever to have heard of them.

They had reached this stage when their success brought the radio engineer and finally his company's president. The Albers brothers had their ideas of what the business was worth, and their visitors agreed with them. First they sold a half interest, but after a year they merged their corporation with the radio company and took stock for their share.

THEY are making several thousand small sets a month for charging radio and automobile batteries. They are also making big sets for powering farms and industrial operations in isolated spots. At a conservative estimate, between 750,000 and 1,000,000 people are enjoying wind-made electricity from their outfits. They have sold sets in every state of the Union, in every province of Canada, and in nearly every country of the world. Now they are thinking in terms of even larger markets where coal is scarce and winds are steady.

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This FREE booklet  
will show you how  
to get it easily



HOLDING onto money you already have is as good as making more that would have to be spent. You can easily save the amount indicated or possibly much more every year by making with Smooth-On No. 1, the repairs for which you otherwise employ a professional "fixer."

For instance, where a pipe, tank or water heater leaks, a heating boiler cracks, any kind of a pressure joint opens, a lock or hinge comes loose, screw threads or nuts strip, a handle won't stay on, or a leak or loose part appears on your car, you can usually make a perfect repair with Smooth-On at a cost of only a few cents for material, and no labor expense or delay.

Smooth-On hardens into solid metal, but is easily applied with the simplest of household tools and without heat or fire risk.

Judiciously made Smooth-On repairs are dependable and permanent, and usually make the performance of the repaired part fully equal to that of a renewal that would cost far more and in addition involve the labor of replacement. Even an emergency Smooth-On repair will at least tide over until a permanent repair can be made with greater convenience and at lower cost.

The free Smooth-On Repair Book gives complete instructions with diagrams for making the commonest household and auto repairs in the easiest and most effective way. Every "handy man" should have a copy of this booklet and a can of Smooth-On in his repair kit.

Be ready for emergencies. Mail the coupon for this free booklet and get Smooth-On No. 1 in 7-oz., 1-lb., and 5-lb. can from any supply store, or if necessary, direct from us.

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For Target & Small Game - Economical - Accurate - Practical - Adjustable Force - Amazing - Maximum Velocity - Safe - Single Shot - with Bolt Action - Hammer Fire - Hair Trigger - Safety - 14" or 22" or 30" or 36" or 42" or 48" or 54" or 60" or 66" or 72" or 78" or 84" or 90" or 96" or 102" or 108" or 114" or 120" or 126" or 132" or 138" or 144" or 150" or 156" or 162" or 168" or 174" or 180" or 186" or 192" or 198" or 204" or 210" or 216" or 222" or 228" or 234" or 240" or 246" or 252" or 258" or 264" or 270" or 276" or 282" or 288" or 294" or 300" or 306" or 312" or 318" or 324" or 330" or 336" or 342" or 348" or 354" or 360" or 366" or 372" or 378" or 384" or 390" or 396" or 402" or 408" or 414" or 420" or 426" or 432" or 438" or 444" or 450" or 456" or 462" or 468" or 474" or 480" or 486" or 492" or 498" or 504" or 510" or 516" or 522" or 528" or 534" or 540" or 546" or 552" or 558" or 564" or 570" or 576" or 582" or 588" or 594" or 600" or 606" or 612" or 618" or 624" or 630" or 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## Highways of the Future

(Continued from page 29)

junction," your guide continues, "your television set picks up the junction transmitter. All you have to do is glance at the viewing screen to find out where the crossroads will take you and how far it is to the next turn-off. And in case you get confused somehow, it's simply a matter of throwing that switch lever to put you in two-way radio communication with highway-patrol headquarters. They'll tell you where you are, how far it is in hours and minutes to your destination, and where to make the correct turn off the highway."

IN CONGESTED areas, you find out, highways are built on elevated structures over railroad lines. The top deck is reserved for private cars, while buses run on a lower level, and streamline trains race along on the tracks beneath. Train passengers transfer at metropolitan terminals to bus platforms for transportation to local stations in city suburbs and villages.

Traffic experts realize that a super-highway similar to the one just described must eventually be constructed—not only to handle an ever-increasing volume of vehicular traffic, but also to end the highway slaughter that in the last fifteen years has taken almost twice as many lives as the total lost in all the wars the United States has fought since the founding of the Republic. Accident statistics show that in many cases the driver is at fault, but the great majority of crashes can be traced ultimately to the roads over which we drive. Better, safer highways are a vital necessity, and extensive road-development programs, now being pushed by state as well as Federal authorities, may lead toward the high-speed superhighways of the future.

Already the State of Pennsylvania is pointing the way by authorizing the construction of what has been called the greatest road engineering project ever undertaken in the United States—a 164-mile, \$80,000,000 toll boulevard stretching through the Allegheny Mountains from Harrisburg to Pittsburgh.

THE proposed route will follow a \$10,000,000 railroad right of way, hacked out of the forests in the 1880's, and on which not one length of track has ever been laid. Built during a bitter feud between rival railroad interests, and abandoned after they concluded a truce, the unused roadbed runs through nine rock tunnels along its route for a total tunnel length of more than seven miles.

Engineers' reports indicate the startling advantages the toll road will have over present traffic routes through the mountains and suggest some of the features that may be expected in future superhighways. From Harrisburg west to Pittsburgh, cars now have to climb nine-percent grades for a total of 13,880 feet. Over the new boulevard, cars will ascend a total of only

(Continued on page 119)



## Highways of the Future

(Continued from page 118)

3,940 feet up grades that never exceed three percent. The route will eliminate four railroad and twenty-six highway grade crossings. Three quarters of its length will be entirely free from curves. On one straightaway, motorists will drive for forty miles without meeting a single bend in the road.

ULTIMATELY, the Pennsylvania toll road may serve as one link in the transcontinental chain of highways proposed by Senator Bulkley and now being studied by a committee. This whole Federal network would also operate under a toll system, scaled to the rate of about one tenth of a cent a passenger mile, in addition to a flat fee of twenty-five cents for each car entering the highway. Thus you would pay a quarter to get on the boulevard at New York and ninety cents to drive the 900 miles to Chicago, if you were alone in the car.

Federal police would man the toll gates and patrol the road. Since every car would be required to stop at toll stations, authorities could bar intoxicated drivers, check licenses, halt automobiles considered unsafe to drive, and enforce uniform traffic regulations—a procedure that might result in one nationwide code of traffic laws and regulations that would apply in every state in the Union.

These road-building developments indicate that the superhighway of the future is definitely on the way. No one can predict exactly what it will be like, but experts are confident that a modern Rip Van Winkle would wake up twenty years from now rubbing his eyes in amazement at the sight of streamline cars racing along broad, divided highways of concrete with a speed and a margin of safety far beyond his wildest dreams.

## POPULAR SCIENCE Question Bee

SEE how you made out in the Question Bee on page 62. In the list below, the letter alongside each number indicates the correct answer to the corresponding question. Check your own answers with these and give yourself four points for each one you had right. A total score of 80 to 92 is good, and 92 to 100 is excellent.

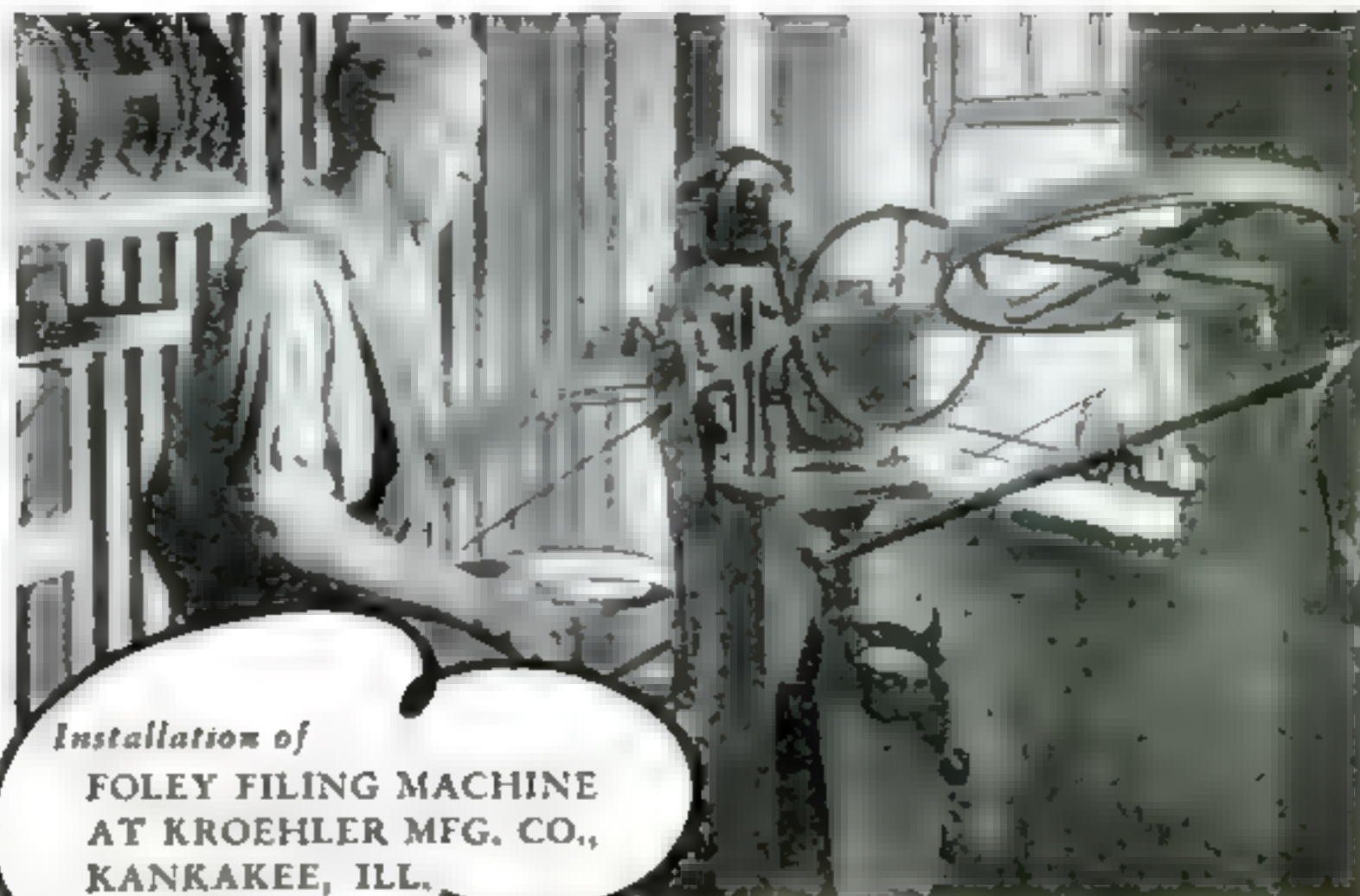
### QUESTIONS

- |      |       |       |       |       |
|------|-------|-------|-------|-------|
| 1. c | 6. b  | 11. b | 16. a | 21. c |
| 2. b | 7. c  | 12. c | 17. b | 22. c |
| 3. c | 8. b  | 13. b | 18. b | 23. d |
| 4. d | 9. d  | 14. b | 19. c | 24. a |
| 5. c | 10. d | 15. c | 20. c | 25. b |

### PICTURES

- |                      |                   |
|----------------------|-------------------|
| 1. spectroscope      | 5. radiometer     |
| 2. optical bench     | 6. galvanometer   |
| 3. Wimshurst machine | 7. wet cell       |
| 4. tuning fork       | 8. dipping needle |
|                      | 9. electroscope   |

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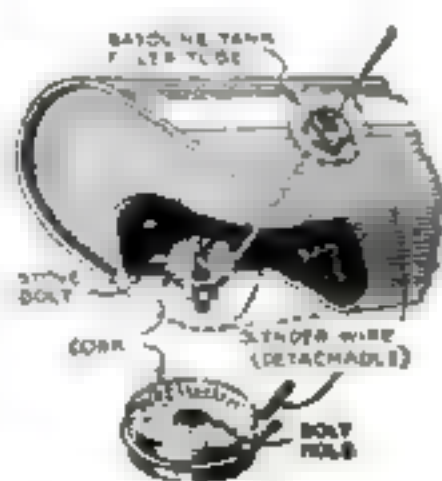


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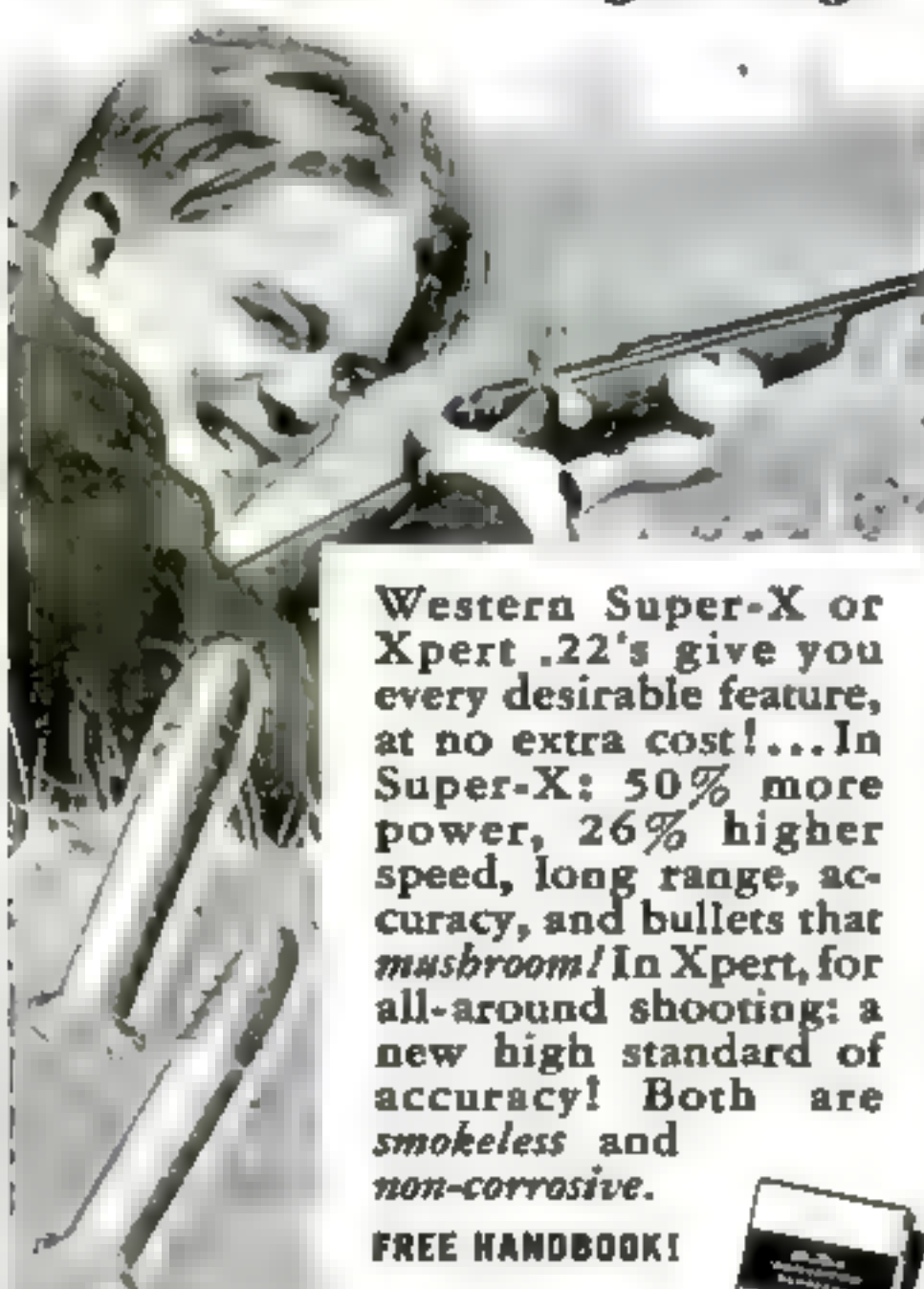
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## Hospital on Wheels Aids Firemen

(Continued from page 39)



Tubular metal splints, another new feature of the fire ambulance's equipment, being applied to a broken arm of one of the smoke eaters

and cold running water. Below, enameled drawers are packed with surgical instruments and medical supplies. There are clippers and shears, tweezers and forceps, magnifying spectacles for examining eyes, and tourniquets of a dozen varieties. Ranged along the table beside the sink are a row of clips, each holding a bottle of ointment or oil for use in treating burns. They can be snatched from the clips in an instant when an emergency arises.

Virtually everything the new ambulance contains has been specially designed to conserve space. Blood-pressure gauges and other aids for the surgeon have been made in the most compact possible form. Midget sterilizers can be plugged into a wall socket above the sink to provide boiling water. When the fire surgeon leaps into the new ambulance at the beginning of a run, he has to be prepared for anything. He never knows what emergencies lie ahead.

A FEW weeks ago, a large rubber-storage plant burned on the outskirts of Brooklyn. Explosion after explosion showered the apparatus and the men with burning rubber. Then, in the midst of treating burns, the surgeon found far more serious cases on his hands. One of the great hoses got out of control. These mighty tubes sometimes pour a ton or more of water a minute from the nozzle. The kick of the high-pressure stream shoves the nozzle to the rear. To keep it in place, the firemen have to tug forward with all their might. In this instance, the hose had broken from their grasp and was causing a lot of trouble.

Writhing like a giant snake, it lashed the heavy metal nozzle back and forth. Four firemen were bowled over like tenpins. One had his skull fractured. Another was struck in the stomach and sent to the hospital for two months. When the new rolling hospital was de-

signed, experts thought ahead and equipped it to meet any emergency which might arise.

An instance of the care with which the interior was planned is the small electric fan that keeps the air circulating within the ambulance. The blades of the fan are made of rubber. Thus, if a lurch or a sudden stop throws the surgeon into its blades, they bend back and do not injure him as they would if they were made of metal.

BY LIFTING tubular frames into place, the interior of the ambulance can be turned into a miniature ward with two comfortable cots for seriously injured men. During a run, if the doctor needs help, as in the case of a bad hemorrhage or of a patient going violently insane, he can signal the driver by pressing a buzzer button. At such a signal, the car would immediately be brought to a stop and the driver would dash to the back of the ambulance to give needed assistance to the physician.

Under the cots are stored the extra tanks of oxygen for the resuscitating apparatus. Firemen who are overcome by smoke often have their jaws clenched so that special mechanisms are needed to open them and insert the oxygen tube. In the old days, in such an emergency the injured man had a tooth knocked out with a hammer and chisel to provide space for inserting the tube. Now, a simple screw device pries the clenched teeth apart. The small end is pushed between the teeth and the device is then turned in the manner of a corkscrew to force it inward and open the clenched jaws. In the hands of a skilled surgeon the operation takes but a few minutes.

ANOTHER recent innovation is the use of metal-tube splints for broken arms and legs. Several are carried in the blanket compartment which is reached through a door on the side of the ambulance. But the most important recent advance is a rigid stretcher. It has folding arms at the back which lock in place, holding it firm, and a trio of wide straps which buckle over the patient and prevent him from rolling off even when the stretcher is tilted sidewise or upside down. On such a litter, injured persons can be brought out of burning buildings through narrow openings and can be lowered vertically to the ground from upper stories. It was developed by Capt. Joseph F. Dunleavy, the man in charge of the new ambulance, under the direction of Commissioner John J. McElligott.

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## Slicing Specimens for Your Microscope

(Continued from page 89)

micrometer graduated in millimeters could be used, so that readings in microns would be easy; but it happens that these inexpensive micrometers are graduated in the English system. Around the edge of the thimble are twenty-five divisions, every fifth one numbered. Each of these divisions represents 1/1000 in., or 25.4 microns. It is easy to estimate fractions of a division, such as 1/2 or 1/3, when feeding the specimen.

THE table over which the knife slides is simply a rigid metal disk fitted to the upper end of the microtome body tube. In the instrument shown, this table was turned from an old carpet-sweeper pulley, and is made of some tin or lead-base alloy. It is attached to the body tube by means of threads and anchored with solder. A better arrangement is to employ a brass disk securely soldered to the tube. File, turn, or grind the surface of the disk and the end of the body tube at its center, to make them perfectly flat and even. If the end of the object holder projects above this flat surface when the micrometer feed is turned upward as far as the bolt in the side slot will allow, remove the holder and shorten it by removing some metal from the upper end. The knife blade should clear this end by a good fraction of a millimeter.

The coil spring (or a rubber band) extending between the object-holder bolt and one at the lower end of the body tube serves to keep the micrometer spindle and the bottom of the object holder in contact, which results in even feeding and uniform thickness of sections.

Specimens that are fairly rigid, such as twigs and stems, can be clamped in the object tube merely by screwing the clamping bolt against them. Softer specimens would be penetrated by the bolt, and not held rigidly. For such materials, make a rectangular sleeve or jaw, slightly curved, that will drop into the well of the object holder, between the object and side where the clamping bolt enters. The end of the bolt presses against this sleeve, and exerts uniform pressure along the length of the well.

LATER you will want to use the microtome to cut paraffin sections. That is, the object to be sectioned will be embedded in a small block of paraffin, which is fed past the knife so that paraffin and object are sliced at the same time. To hold such paraffin blocks, make a fitting that will drop into the well of the sliding object holder. The one shown was made from a machine bolt. A flat place was filed in the threaded portion to receive the end of the clamping bolt. The head was split with a hack saw to reduce it to a thickness of about 3 mm., and turned to a diameter equal to that of the outside of

(Continued on page 122)

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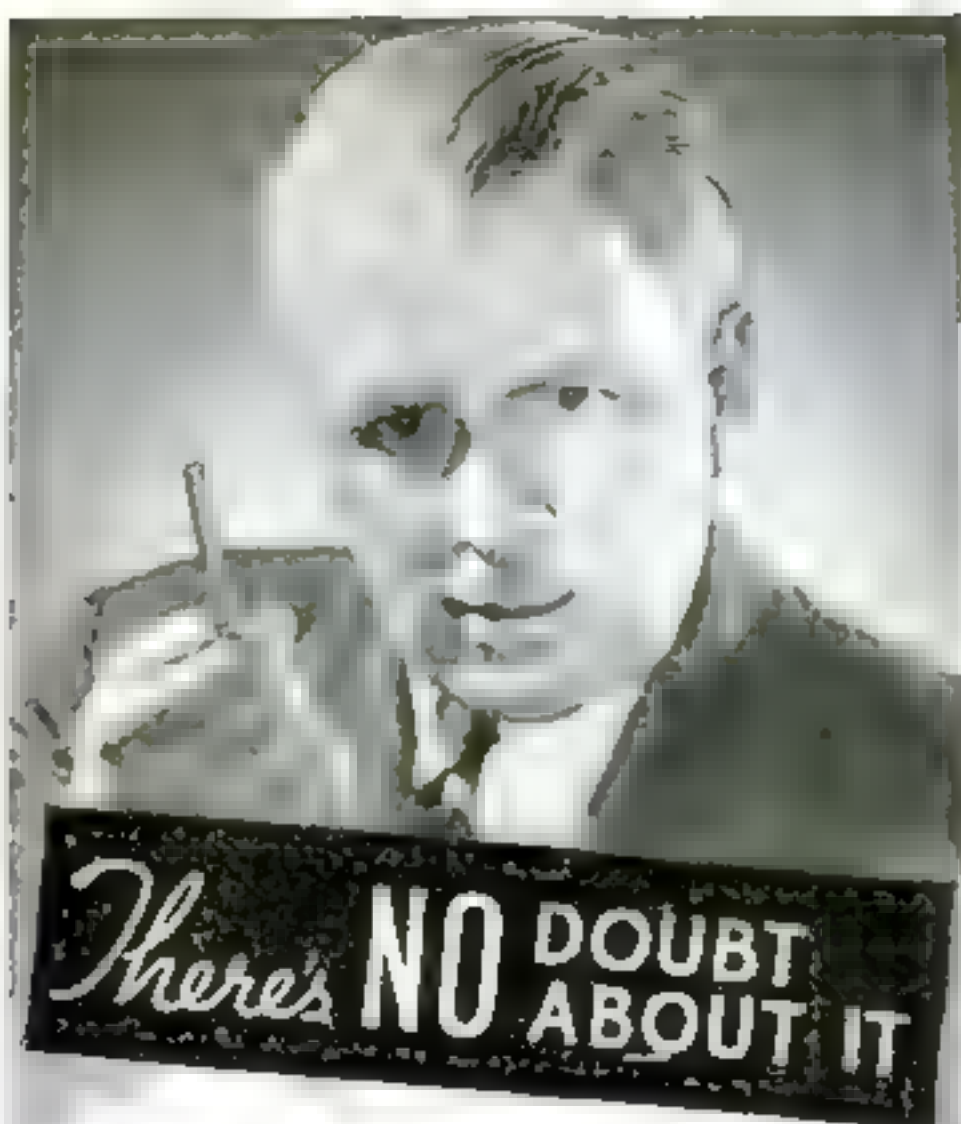
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MITER SAW

## Slicing Specimens for Your Microscope

(Continued from page 121)

the object holder. The face, or upper surface when the fitting is in place, was grooved with a file, to make the paraffin stick better. In use, the holder is warmed and pressed in contact with the paraffin block, which is then trimmed flush with its edges. You can, instead of making such a fitting, fashion a length of cylindrical rod, drilling and tapping it for the bolt entering through the side slot. This rod takes the place of the hollow object holder.

THE microtome at this stage is complete, if you want only a hand-held instrument. But for a few cents and a few minutes more, you can make it fasten rigidly to a table. Obtain a small C clamp of a type similar to that shown, and file or saw the back edge of the frame until it is flat enough to rest firmly against the side of the microtome body tube. Drill two holes through the frame to receive short 6-32 machine bolts, which enter threaded holes in the tube. The sliding handle in the clamp illustrated was bent at right angles, to reduce its length so it would clear the micrometer thimble.

Much of the success in sectioning depends upon the knife used for cutting. Special microtome knives are obtainable, but costly. An old-fashioned, straight-back razor, if sharp, will do nicely; or you can buy, for a little over three dollars, a special sectioning razor. This is similar to the ordinary razor, but has a straight edge and one side that is flat. Cheapest of all, and capable of very accurate results, are ordinary safety-razor blades. These should be clamped in a holder that will keep them straight and rigid, or the cutting edge will have a tendency to bow down as it passes over the hole in the center of the microtome table. Some types of paint scrapers which employ razor blades can be used.

It is a good idea to select the best blades out of a given assortment, by examining the edges with your microscope for sharpness and uniformity.

Now that your microtome is complete, you can try it out on a few easily obtained specimens. Some materials can be cut directly without special preparation, others are best sectioned after treatment to harden or soften them, or after they have been surrounded by some supporting material.

PERHAPS the best objects to start with, in acquiring skill with your newly made microtome, are stems and roots of plants. By cutting sections in various directions—cross sections, longitudinal sections, and so forth—you can learn much about plant structure. Cross sections are generally the most interesting, and make particularly beautiful objects when stained with methylene blue, eosin, and other dyes.

When sectioning hard, woody stems,  
(Continued on page 123)

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## Slicing Specimens for Your Microscope

(Continued from page 122)

or pieces of lumber (which are parts of larger stems), you usually can clamp them in the microtome without providing any surrounding material to support them. Softer stems have to be supported by some auxiliary material. There are various suitable materials for this form of simple embedding. Generally, cork is used for fairly rigid stems and similar objects. For the more delicate materials, you can use dry elder pith, pieces of raw carrot or potato, or in fact anything that will provide the necessary rigidity and at the same time can be cut easily.

**TO MOUNT** a stem so that it will be supported by, say, a cylinder of cork, trim the cork until it will enter the object holder of the microtome. Then split the cork cylinder in two along its axis, and with a sharp knife cut two small V notches so that, when the halves are put together, the notches will form a rectangular hole. The shortest diameter of this hole should be slightly less than that of the stem. Place the stem between the halves, like a "hot dog" in a bun, and clamp the sandwich in the microtome. Take two or three fairly heavy cuts to square up the end, and then make the sections, cutting them as thin as possible.

Instead of the V grooves in the halves of the embedding material, you can cut semicylindrical ones, if you like. Perhaps a small carving tool would be ideal for this. Still another way is to punch or drill a hole in the cylindrical plug without splitting it, and push the stem into this hole.

If you want sections of wood, it is best to cut them from the green stem rather than from seasoned wood. Cut the stems into short lengths, and soak them for several days in strong alcohol, to remove the resin. Then soak them a few more days in water, to dissolve out any gummy matter present. The stem should then be fairly easy to cut. If you want to section seasoned wood, split pieces to a size that will enter the microtome, and soak them for several days in water, or boil if necessary. Further treatment with alcohol and again with water, as in the case of green stems, usually will soften the wood still further.

**IN CUTTING** stems and the like, curling can be reduced or prevented by having the stems and the knife blade wet with water. The section will float up on the blade and lie flat. It can be washed off by dipping the blade in a jar of water, or it can be lifted off and transferred to a dish of water with a small camel's-hair brush. Treatment of the thinly sliced specimen after that may take any of various forms. For immediate inspection under your microscope, the stem section can be mounted in glycerin, or in a weak alcoholic solution.



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# Wild Animals Are His Hobby

(Continued from page 45)

But to get back to the second step in the preparation of a mixed act. This is taking the animals into the arena, one at a time, and training them to obey simple commands—for example, to climb on a pedestal when the trainer cracks his whip and taps the top of the stand. There follows, as the third step, the coaching of the different animals in their special tricks. Thus, the leopard is taught to jump through a burning hoop; the lions to ride on a seesaw; the bear to balance itself steadily on a rolling ball.

THIS last trick, alone, may require two months of daily rehearsing. When anything moves under an animal, its instinctive impulse is to jump. The bear is taught to sit up on the stationary ball first. Then, by putting the sphere on increasingly steep inclines, it is trained to keep on top as the ball rolls along. The final step is "cuing" the animals so they know when to begin their particular tricks. When these signals are letter perfect, the beasts are ready to put on their mixed act in public.

While such acts are most likely to produce fireworks, many of Keller's arena thrills have come while he was working with only one or two animals.

A couple of years ago, for example, he was training Simba, a 170-pound mountain lion from Arizona, to leap twenty feet through hoops from one pedestal to another. Somehow, one of the guy wires that braced the second stand had become loose, and the pedestal swayed as the great cat struck it. Keller saw the cougar land all right, and turned his attention to a second animal on the other side of the ring. An instant later, the 170-pound Simba landed on top of him. Its great claws ripped the whole back out of the leather jacket he was wearing, and the impact knocked him flat.

When the mountain lion had felt the stand sway under it, it had instinctively leaped for the nearest object—which was Keller. It had landed on his back, just the same as it would have hit the trunk of a tree. Although it meant no harm, it gave Keller probably the biggest surprise of his animal-training life.

THIS cougar was one of the most intelligent creatures that Keller ever handled. Its eyes, he noted, were set unusually far apart. It came to him from a Government trapper in Arizona when it was about eight weeks old. As the only mountain lion ever to walk a tight rope, it attracted wide attention and traveled with one of the leading American circuses. Later, it toured the country advertising the motion picture "Sequoia."

At present, Keller is working up a spectacular "Albino Act." Five all-white animals will take part. He has a white deer, an albino porcupine, an

albino opossum, and two white squirrels. Up until a few days ago, he had a great snowy owl included among the performers. It escaped, however, while he was taking moving pictures of it in the open.

Probably the strangest story connected with Keller's back-yard menagerie is the tale of Lobo, the tame wolf. This animal arrived at Bloomsburg when it was a small puppy. It grew up to be as gentle as a collie. It used to accompany Keller on long hikes in the woods, roving through the underbrush and coming at a whistle from its master.

ONE winter, Lobo starred in a production of "Little Red Riding Hood" given at the college theater. It trotted out on the stage, a full-grown gray wolf, following a little girl who played the part of Red Riding Hood. Another time, its collar broke and it roamed about the campus for a quarter of an hour before it heard Keller's sharp whistle and came running to his side.

For three years, Lobo lived the life of a pet, sharing its cage with a pedigreed female police dog which became its mate. Then, a man in a neighboring town offered a high price for the female and Keller agreed to sell her. The wolf, watching through the wire of its cage, saw the stranger hand over the money and then, taking the leash, lead the police dog away. In an instant, all Lobo's trust in man disappeared. When Keller tried to feed it, it leaped clear across the cage at his throat. When he put a female wolf in the pen to take the place of the police dog, it tried to tear her to pieces. Finally, the animal became so violent, it had to be shot.

All told, Keller has had more than 100 animals and birds in his home menagerie. The only bird he has tried to train was Nina, a five-year-old golden eagle from Colorado. It took him about nine months to teach it to hunt like a falcon.

THE cost of food for his back-yard zoo runs to about five dollars a day. He has to buy twenty pounds of raw meat daily, the lion and two cougars consuming five pounds apiece.

But the hobby is paying for itself. Trained animals sell for several times as much as untrained ones. Keller can buy an African lion cub, for example, for about \$100. When it is trained, he can dispose of it for from \$250 to \$300. At the end of the season, he sells the best of his performers to dealers who supply circus and vaudeville men, here and abroad.

The saying, "Every day is circus day at Kellers," which you often hear in Bloomsburg, is doubly true. Not only is Keller providing an exciting show for onlookers, but, he says, he is having a circus himself in the pursuit of his unique and thrilling hobby.



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## Color Chemistry

(Continued from page 91)

be agitated similarly with a stirring rod, but no cotton is placed in this solution.

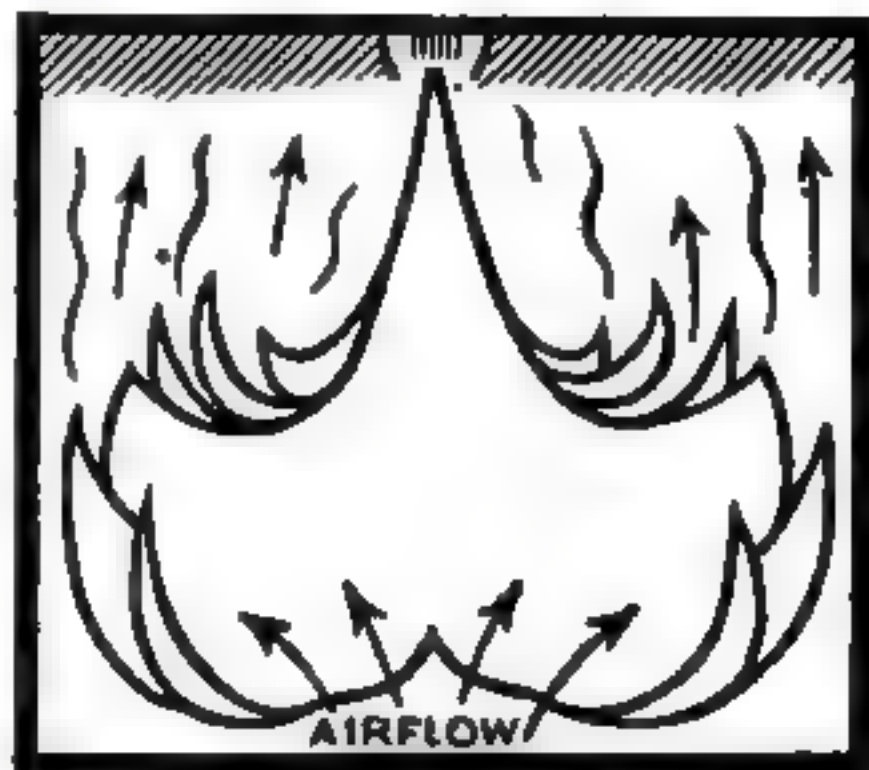
Now withdraw one cubic centimeter of liquid from each beaker, with a pipette, placing the samples in separate test tubes. Add fifteen cubic centimeters of water to each tube. Then bubble hydrogen sulphide gas through each sample of liquid for about five minutes. The solutions will both turn dark, because of the formation of lead sulphide. Place the two tubes in your colorimeter and look down through them. You will plainly observe that one of the solutions—the one in which you placed the cotton—is lighter than the other.

BY THE process of adsorption, which means the adhesion of molecules of a gas or a dissolved substance to a solid body, the cotton has removed some of the lead chemical, leaving less to react with the hydrogen sulphide gas and form lead sulphide. Although the amount of lead taken out of solution is small, the colorimeter should clearly reveal the phenomenon. If it does not, you have probably used so much of the lead chemical that the tubes are too deeply colored to show any difference in tint, and you should try the experiment again with a smaller quantity.

One way you can make the hydrogen sulphide gas is to dilute sulphuric or hydrochloric acid with four times its volume of water and add the acid, in a suitable vessel, to lumps of iron sulphide (ferrous sulphide). You will not have to purchase iron sulphide or an acid to generate hydrogen sulphide for this and other experiments, however, if you use the simple little generator shown in one of the accompanying pictures.

THIS convenient source of hydrogen sulphide consists of a flask in which ordinary paraffin or candle wax is placed, together with some flowers of sulphur. Some glass wool or asbestos fibers can be added to facilitate the contact of these two materials, which supply respectively the hydrogen and the sulphur of which the gas is composed. Whenever the flask is heated, a good stream of hydrogen sulphide is obtained. As soon as it cools, the contents solidify and will not spill, so that the flask can be tipped on its side and placed in a drawer, if desired, for future use. The generator may be heated by a candle flame, an alcohol lamp, or the miniature electric heater shown—a cigarette lighter screwed into a 110-volt socket and operated directly from the house current. If the flask is of heat-resisting glass, the conventional wire screen between the vessel and the source of heat may be omitted. In the handy arrangement illustrated, the flask is clamped to a support and mounted with the heater on a wooden base, so that it is permanently set up and ready for service.

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## SHUNNED AT SCHOOL BECAUSE OF PIMPLES?

### Take steps to free your blood of skin-defiling poisons

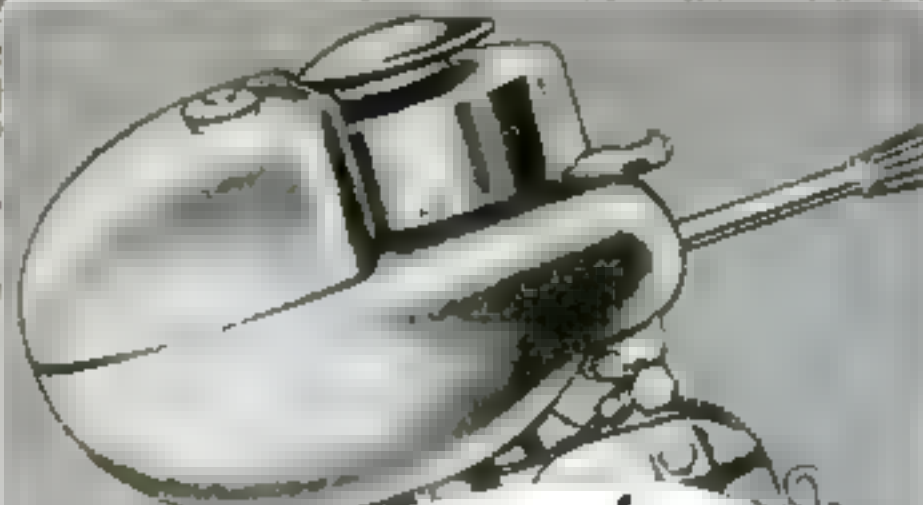
Stop being the victim of ugly hickies. Don't be shunned and laughed at. Get right to the root of the trouble. It may be poisons in your blood.

Between the ages of 13 and 25, important glands are developing. These gland changes often upset your system. At the same time, waste poisons from the intestinal tract may collect in the blood stream... bubble out on your skin in disfiguring pimples.

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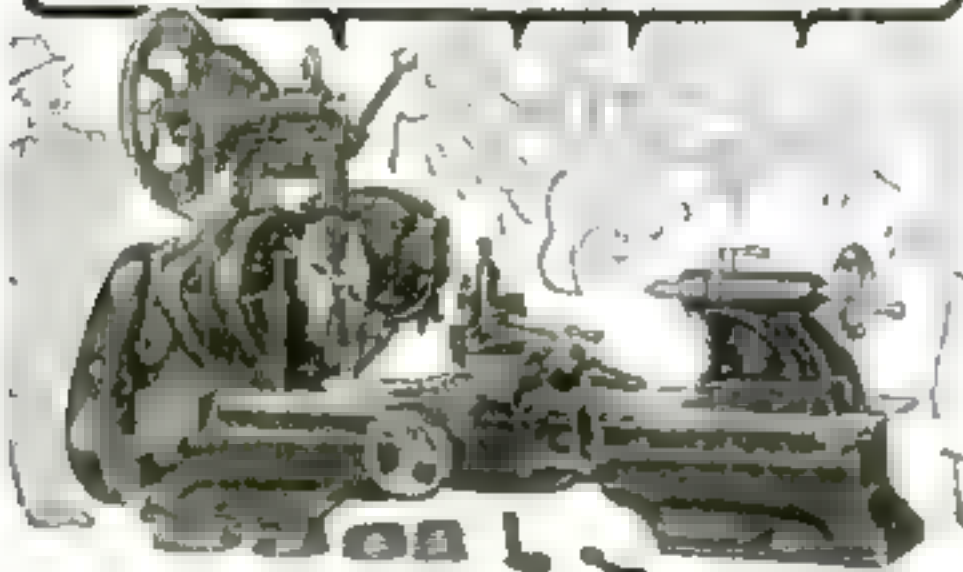
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# Gus Settles a Family Quarrel

(Continued from page 66)

the door. "Let me try it, Mrs. Snodgrass," he suggested. She got out, the running board groaning under her 250 pounds. "This is *my* car," she said. "That little bantam gave it to me for my birthday. Just get it running, mister, and then tell me how to get on the Lincoln Highway from here. That's all I want!"

"Lincoln Highway!" shouted her husband. "What d'you think you want to get on the Lincoln Highway for?"

"ACCORDING to the road map it runs through Reno," the woman said bitterly. "I'm going to get on it, and stay on it until I get there!"

"Well, now, let's see," Gus said soothingly. He got into the car and pressed the starter with his foot. Again the engine purred smoothly. He got out, leaving it running. "Try again, please, Mrs. Snodgrass," he said. She climbed in—and before she had settled her ample self in the driver's seat the engine had stopped! "I've had just about enough of this monkey business!" she snapped ominously.

Gus slowly scratched his head just above his right ear. Then he leaned over and began fussing with the floor boards. When he straightened up he had one of them in his hand. "Step on the starter—just this once more, Mrs. Snodgrass," he requested.

She did as he asked. The engine started—and kept on running!

Gus laughed. "We've chased out that devil!" he said. He held up the floor board and pointed to a little metal bracing plate screwed to its lower side. "That's him. See what happened? When this floor board is in its place, that metal plate is just over the fly-wheel generator plug. Mr. Snodgrass and I aren't heavy men, so when either of us was in the driver's seat nothing happened. But Mrs. Snodgrass weighs—er—weighs a little more, so when she got behind the wheel the floor boards were pressed down on that side of the car until the metal plate came into contact with the top of the generator plug and grounded on the engine block. Naturally, that shorted the ignition system. You'd better leave that floor board out, Mr. Snodgrass, until you can get a carpenter to do a little job of bracing under that side of the floor."

THE little man was all smiles now. "You're a wonder, Mr. Wilson," he said generously. "You've lived right up to your reputation as a trouble sleuth. How much do I—"

"Oh, nothing—nothing at all," Gus said. "That was a brand-new one on me, and it's restored my faith in the general cussedness of automobiles. When they get all the little devils chased out of 'em, I'll have to look around for another line of business." He turned to the woman with a wide

smile. "Now you can drive anywhere you want to—except maybe on that Reno road?"

The stout woman smiled and blushed as she let in her clutch. "Maybe I'd better go on a diet instead!" she said. "Thanks a lot, Mr. Wilson!"

When Jack Kelly came in for his car late that afternoon, Gus told him about the Snodgrass affair. "Say, Gus," Kelly said admiringly, "doesn't anything ever stump you?"

Gus leaned against his workbench while he crammed long cut into his pipe, and Kelly knew that he was going to hear a yarn.

"Yep, I've been stumped many times—plenty stumped," Gus said. "And it was what you might call an ignition mystery that had me stumped worse than I've ever been stumped before or since."

"When I was younger, ants used to get in my pants—I couldn't have stayed in one place more'n six months to save my life. Well, that was O.K.—I wasn't married, and I never had any trouble finding a job. So when I'd seen enough of one town, I'd just roll along to another one."

ONE spring day, years ago, I was out in eastern Colorado and a friend of mine out there told me one of the queerest motor-trouble stories I think I've ever heard. He had an almost new Dort six, and it was purring along the road one day at maybe forty or forty-five miles an hour, and everything was lovely—except that a strong northeast wind was blowing a lot of dust around.

"He was traveling through rolling country, and pretty soon he noticed that a couple of cars were stopped in a cut a half mile ahead. When he got into the cut his motor went dead. He stepped on the starter, but the engine wouldn't take off. He tried everything he knew—nothing doing. Several other cars came along, and stopped in the same mysterious way. The air was blue with cussing, and no one could get started. Inside of an hour he claimed there were fourteen cars stalled in that cut!"

"Then another funny thing happened. A Model T Ford came along, and its engine kept right on running. The driver couldn't help the other cars to get started, but he did the next best thing—he took one of the men along to a ranch house a couple of miles down the road, where he could telephone to the nearest town for a wrecker. By the time this fellow had walked back to the cut, there were twenty-three cars stalled in it. But a half dozen Model T Fords had gone through without the slightest trouble!"

"After a while the men saw the wrecker coming along the road. It was an old Chevy, and when it got into the cut it stalled. After the mechanic who

(Continued on page 127)



This One

This One



GAXW-XKQ-KGJH



## Gus Settles a Family Quarrel

(Continued from page 126)

was driving it had kicked at his starter for a while without getting any action, he got out and started to pull tools out of the back of the wrecker, cursing because some one had thrown a lot of pieces of chain over them. My friend noticed that he left one length of chain trailing down over the tailboard onto the road.

"THE mechanic fooled with his motor for a while, and then got in and gave his starter another kick. And his engine started! So he threw all his tools back into the car. Then he noticed the piece of chain hanging over the tailboard, and threw that in, too. And his engine stopped!

"That was the tip-off. All of the drivers fastened skid chains or pieces of wire to the backs of their cars, so that they trailed in the road, and they all got started without any trouble. After they'd gone a few miles, my friend got out and put his skid chain back in the car, and she went on running all right." Gus stretched and yawned. "Well, guess it's time for me to go home for supper," he remarked.

"Wait a minute—wait a minute!" sputtered Kelly. "Finish your story. What made all the cars but the Model T Fords stall?"

"That's what I couldn't figure out," Gus said. "And it bothered me plenty. So when I got to Boulder I went up to the University of Colorado and told a fellow who taught electrical engineering about my friend's story—half expecting him to think that one of us was a liar. But he said that he'd seen the same thing happen before when there was a stiff wind blowing. Seems that the shifting sands created static electricity that short-circuited batteries, and that the chains or wires hanging out of the cars onto the road grounded it. Naturally, it didn't affect the old Model T Fords—they ran off magnetos, and didn't have any batteries!"

## Highways in Colors To Guide Motorists

HIGHWAYS tinted in pink, blue, lilac, and various other distinctive colors, may be among the roads of the future, if an English plan is carried out. Because there are so many highway signs on modern roads, it is argued, motorists are frequently confused rather than informed by the written directions. When a representative of the British Road Federation suggested to the British Ministry of Transport that lamp-posts and other roadside poles on a certain route be marked in various distinguishing colors, critics declared this would merely add confusion to the already confusing welter of signs and symbols. As an alternative, the critics suggested the use of tinted concrete or asphalt for the roadway itself.

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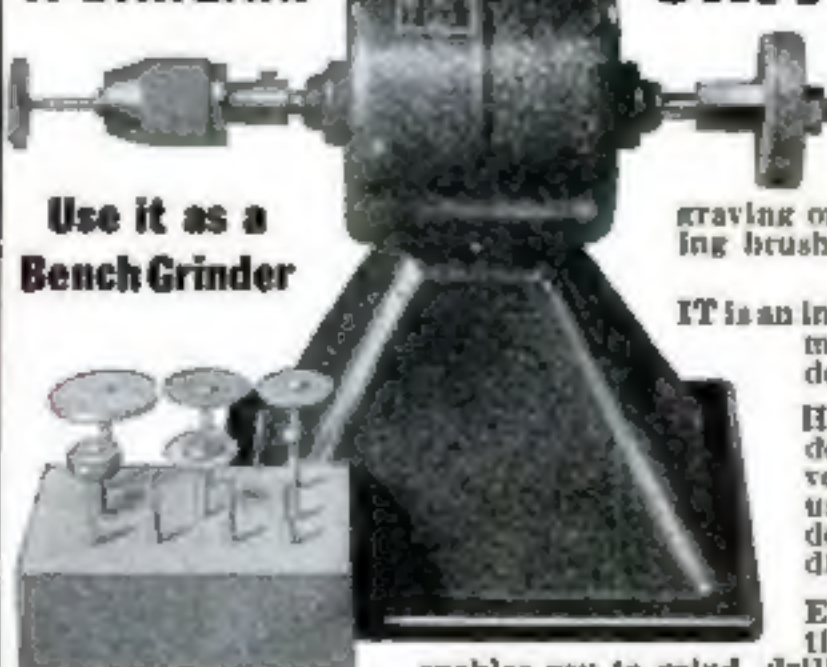
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# Modern Avocado Groves Bring You an Ancient Fruit

(Continued from page 49)

limbs by removing a section of bark, thus isolating those limbs from the rest of the tree, improves production by causing each limb to bear a heavier crop the next year. Also, controlled fertilization in on-crop years increases an already large crop; but fertilization in an off-crop year, for reasons science cannot explain, decreases an already poor yield.

Less is known about the growing of avocados than about any other American crop. Were you to visit the groves in Dade County, Florida, or on the hill-sides of Southern California, you would find one grower delivering water into furrows for irrigation, another into basins, while a third operates an overhead sprinkling system. A variety of trees thriving on one hill will not produce well on another hill twenty-five miles distant.

**T**HERE are four general classifications for avocados: Mexican, Guatemalan, West Indian, and their hybrids. Fruit of the Mexican type are characteristically small, usually well under a half pound, thin-skinned, nut-flavored, and rich in oil. This type grows only in Mexico and California. The Guatemalan type is large, thick-skinned, and also rich in flavor and oil. It flourishes in northern South America, Central America, Mexico, and California. The fruit weigh from one to four pounds apiece.

The West Indian type compares in size with the Guatemalan, and is also thick-skinned. This type is grown mainly in Cuba and Florida.

Hybrids are propagated in a continuous effort toward improvement. The outstanding hybrid, California's *Fuerte*, is considered to be a cross between the Mexican and Guatemalan types.

**A**BOUT 13,000 acres of commercial avocado plantings dot Southern California's rolling hills. The tree is stocky in appearance because it is usually pruned at a height of twenty or thirty feet, which causes it to produce more abundantly. A member of the laurel family, it is an evergreen, with large, waxy leaves that flicker in the strong sun. The growing area is confined principally to a coastal ribbon extending from Santa Barbara on the north to the Mexican border on the south, a highway distance of 250 miles.

Oddly, only laboratory tests reveal when an avocado is ripe. Since color does not indicate the degree of ripeness on the many varieties, sample fruits from individual groves are carried to the laboratory at picking time. There each fruit is peeled. Half of it is ground and reground in a mortar, and an oil is added to determine the difference in refraction between the avocado meat and the oil. This refraction difference indicates the oil content. Un-

less the samples yield twelve percent of oil, the grower must await later tests before his fruit will be accepted for marketing.

From grove to retail store, avocados are handled as carefully as eggs, for they bruise easily. In the field, ranch workers cut the stem at the base of the fruit with special clippers, carefully avoiding stabbing the skin. Avocados growing beyond the reach of men on ladders are taken with pole clippers, down which the fruit slides through a narrow canvas chute to the base, where it is carefully removed and placed in a field box which holds forty pounds of fruit. These boxes are delivered to a packing house, where attendants record delivery by name of the grower, district, date, quantity, and variety.

Here the field boxes are turned upside down and the fruit is poured into a canvas container, from which it moves on a canvas belt through a cleaner of revolving brushes and cloths, then onto brightly lighted tables, where experienced graders inspect it for shapeliness and freedom from scars.

If a few of the incoming avocados are blotched, they are left on the moving belts to be diverted to a lower grading. Those which pass inspection for "extra-fancy" grading drop into little rubber pockets moving along on an endless chain, and are carried under a revolving wheel rimmed by a metal belt which stencils a brand name on each fruit.

Next, the fruit is separated as to size by a system of graduated weights. Heavier fruit springs trapdoors which permit it to roll into a circular, revolving bin whose floor gradually sinks under the weight of incoming fruit. The smaller fruit springs others traps farther along the line.

**A**T EACH bin, packers place the fruit in even rows in excelsior-lined, open-slat crates which hold thirteen pounds each. Only one variety is run through a grading table for a given packing, so that each box contains a single variety of fruit. After being lidded automatically, the boxes are wheeled into an air-conditioned cooler, where they are kept a full day at forty-two degrees F., before being wheeled into refrigerated trucks and railroad cars for shipment.

In addition to extra-fancy grades, two lower grades are packed. Culls are pressed into oil, which goes into the making of cosmetics in the United States and abroad. A fifth classification, the "cukes," are seedless and resemble large dates. These are offspring of blossoms which failed to pollinate. Rubbery unless fully mature, they possess a high value as novelty fruit.

Unknown to the nation at large a dozen years ago, when the few avocados reaching the public were called alligator pears, this fruit of the Toltecs and Mayans is as new as any food on your table. Science and daring exploration have combined to give it new life and better taste.

## Hunter Rides "Everglades Cruiser"



**F**OR hunting deer, wild boar, and wildcats in the Florida Everglades, Guy Peebles, Miami sportsman, built the odd vehicle pictured above. Called an "Everglades cruiser," it is specially designed for negotiating swamps and can travel through water three feet deep. While a companion pilots the car, the hunter watches for game from an elevated platform



# POPULAR SCIENCE-ON-THE-SCREEN

THE NEWSREEL OF SCIENCE AND INDUSTRY



Modern functional design brings dressing room, sitting room and breakfast room to the sleeping quarters. Books, radio, telephone, electric clock, built-in make-up box, set-up for night cap and morning coffee-and-toast are all here within arm's reach.



The take off—a shot from one of the most dramatic short sequences ever made—depicting a rescue at sea by the U. S. Coast Guard. Popular Science On-the-Screen is produced in Cinecolor by Carlisle & Fairbanks with the cooperation of the editors of Popular Science Monthly.

*A Paramount Picture*  
AT YOUR NEIGHBORHOOD MOVIE

IN SOUND AND COLOR

Editors of POPULAR SCIENCE MONTHLY  
353 Fourth Avenue, New York City

I have never seen POPULAR SCIENCE-ON-THE-SCREEN at my neighborhood movie. Your cooperation in having it brought here will be greatly appreciated.

My name \_\_\_\_\_

My address \_\_\_\_\_

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Theatre's address \_\_\_\_\_

6-25



MEL KOONTZ—FAMOUS HOLLYWOOD ANIMAL TAMER—WRESTLES A LION!



Here is Mel Koontz alone in the cage with four hundred and fifty pounds of lion. The huge lion crouches—then springs at Koontz. Man and lion clinch while onlookers feel their

nerves grow tense. Even with the lion's jaw only inches from his throat, Mel Koontz shows himself complete master of the savage beast. No doubt about *his* nerves being healthy!

**"I'll say it makes a difference to me what cigarette I smoke"**

says

**MEL KOONTZ to PENN PHILLIPS**



MEL KOONTZ was schooling a "big cat" for a new movie when Penn Phillips got to talking cigarettes with him. Perhaps, like Mr. Phillips, you, too, have wondered if there is a distinct difference between Camels and other cigarettes. Mel Koontz gives his slant, above. And millions of men and women find what they want in Camels. Yes, those *costlier tobaccos* in Camels *do* make a difference!

PEOPLE DO APPRECIATE THE  
**COSTLIER TOBACCOS**  
IN CAMELS

THEY ARE THE  
**LARGEST-SELLING**  
CIGARETTE IN AMERICA

Camels are a matchless blend of finer,  
MORE EXPENSIVE  
TOBACCOS — Turkish  
and Domestic



ONE SMOKER TELLS ANOTHER...

**"Camels agree with me"**

**"We know tobacco because we grow it.....We smoke Camels because we know Tobacco"**

**TOBACCO PLANTERS SAY**



"I know the kind of tobacco used for various cigarettes," says Mr. Beckham Wright, who has

spent 19 years growing tobacco—knows it from the ground up. "Camel got my choice grades this year—and many years back," he adds. "I'm talking about what I *know* when I say Camels sure enough are made from MORE EXPENSIVE TOBACCOS."

Mr. George Crumbaugh, another well-known planter, had a fine tobacco crop last year. "My best



yet," he says. "And the Camel people bought all the choice lots—paid me more than I ever got before, too. Naturally, Camel's the cigarette I smoke myself. Most planters favor Camels."



"I've grown over 87,000 pounds of tobacco in the past five years," says this successful

planter, Mr. Cecil White, of Danville, Kentucky. "The best of my last crop went to the Camel people at the best prices, as it so often does. Most of the other planters around here sold their best grades to Camel, too. I stick to Camels and I *know* I'm smoking choice tobaccos."

"My four brothers and I have been planting tobacco for 21 years," Mr.



John Wallace, Jr., says. "Camel bought up every pound of my last crop that was top grade—bought up most of the finer tobacco in this section, too. I've been smoking Camels for 17-18 years now. Most other planters are like me—we're Camel smokers because we know the quality that goes into them."

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